CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY
Autonomous Institution under UGC
Hyderabad-500075

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

AICTE Model Curriculumof Instruction
and
Syllabi of M.E. (ECE-ES & VLSID)

M.E. (ECE)
EMBEDDED SYSTEMS & VLSI DESIGN
(With effect from the AY 2019-20)

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY(A)

Our Motto: Swayam Tejaswin Bhava

Vision, Mission and Quality Policy of the Institute

VISION

To be a centre of excellence in technical education and research.

MISSION

To address the emerging needs through quality technical education and advanced research.

QUALITY POLICY

Chaitanya Bharathi Institute of Technology imparts value based technical education and training to meet the requirements of student, industry, trade/ profession, research and developmental organisations for self-sustained growth of society.

Vision and Mission of Dept. of ECE

VISION

To develop the department into a full-fledged center of learning in various fields of Electronics & Communication Engineering, keeping in view the latest developments.

MISSION

To impart value based technical education and train students and to turn out full pledged engineers in the field of Electronics & Communication Engineering with and overall background suitable for making a successful career either in industry/ research or higher education in India/Abroad.

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Program Educational Objectives of M.E (Embedded Systems and VLSI Design) Program

PEO1 Graduates will excel in Design and development of Embedded Systems and VLSI Design areas.

PEO2 Graduates will become successful in executing software related to Integrated Circuit Design and Embedded System applications.

PEO3 Graduates will carry out research in new technologies relevant to Embedded Systems and VLSI Design.

PEO4 Graduates will develop with professional ethics, effective communication skills and knowledge of computing and information technologies.

Program Outcomes of M.E (Embedded Systems and VLSI Design) Program

PO1 Student will demonstrate an ability to identify, formulate and solve complex engineering problems with the fundamentals of Electronic Circuit Design and development of Embedded Systems.

PO2 Student will demonstrate an ability to visualize and work for research in the fields of Embedded Systems and VLSI Design.

PO3: Student will be able to use modern engineering tools based on software, hardware and measuring testing equipment to analyze problems.

PO4 Student will develop self-confidence, ability to work in team and skills for life-long learning.

PO5 Student will demonstrate an ability to design a system, component or process as per the specifications.

PO6 Student will understand the impact of complex engineering solutions in a global, economic, environmental and societal context.

PO7 Student will understand and commit to professional ethics and social responsibilities.

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
M.E (Embedded Systems & VLSI Design)

SEMESTER – I

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	19EC C201	Analog and Digital CMOS VLSI Design	3	--	--	3	30	70	3
2	19EC C203	Microcontrollers and Programmable Digital Signal Processors	3	--	--	3	30	70	3
3		Program Elective-1	3	--	--	3	30	70	3
4		Program Elective-2	3	--	--	3	30	70	3
5	19ME C103	Research Methodology and IPR	2	--	--	2	25	50	2
6		Audit Course-1	2	--	--	2	--	50	Non Credit
PRACTICALS									
8	19EC C205	Analog and Digital CMOS VLSI Design Lab	--	--	4	--	50	--	2
9	19EC C206	Microcontrollers and Programmable Digital Signal Processors Lab	--	--	4	--	50	--	2
Total			**16**	**--**	**8**	**--**	**245**	**380**	**18**
Clock Hours per Week: 24									

L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Examination

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
M.E (Embedded Systems & VLSI Design)

SEMESTER – II

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	19E C202	Embedded System Design Using RTOS	3	--	--	3	30	70	3
2	19EC C204	VLSI Design Verification and Testing	3	--	--	3	30	70	3
3		Program Elective-3	3	--	--	3	30	70	3
4		Program Elective-4	3	--	--	3	30	70	3
5		Audit Course-2	2	--	--	2	--	50	Non Credit
PRACTICALS									
8	19EC C207	RTL Simulation and Synthesis with PLDs Lab	--	--	4	--	50	--	2
9	19EC C208	RTOS and VLSI Design Verification Lab	--	--	4	--	50	--	2
10	19EC C209	Mini Project with Seminar	--	--	4	--	50	--	2
Total			**14**	**--**	**12**	**--**	**270**	**330**	**18**
Clock Hours per Week: 26									

L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Examination

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
M.E (Embedded Systems & VLSI Design)

SEMESTER – III

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1		Program Elective-5	3	--	--	3	30	70	3
2		Open Elective	3	--	--	3	30	70	3
3	19EC C210	Dissertation /Phase-I	--	--	20	--	100	--	10
Total			**6**	**--**	**20**	**--**	**160**	**140**	**16**
Clock Hours per Week: 26									

L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Examination

CHAITANYA BHARATHI INSTITUTE OF TECHNOLOGY (A)
M.E (Embedded Systems & VLSI Design)

SEMESTER – IV

S.No	Course Code	Title of the Course	Scheme of Instruction			Scheme of Examination			Credits
			Hours per Week			Duration of SEE in Hours	Maximum Marks		
			L	T	P/D		CIE	SEE	
THEORY									
1	19EC C211	Dissertation /Phase-II	--	--	32	Viva - Voce	100	100	16
Total			**--**	**--**	**32**	--	**100**	**100**	**16**
Clock Hours per Week: 32									

L: Lecture T: Tutorial P: Practical D: Drawing
CIE: Continuous Internal Evaluation SEE: Semester End Examination

List of Courses for the Program ME (ECE) with specialization
EMBEDDED SYSTEMS & VLSI DESIGN

S.No	Course Code	Program Core Courses
1	19EC C201	Analog and Digital CMOS VLSI Design
2	19EC C202	Embedded System Design using RTOS
3	19EC C203	Microcontrollers and Programmable Digital Signal Processors
4	19EC C204	VLSI Design Verification and Testing
Practical Courses / Mini Project with Seminar/ Disseration		
5	19EC C205	Analog and Digital CMOS VLSI Design Lab
6	19EC C206	Microcontrollers and Programmable Digital Signal Processors Lab
7	19EC C207	RTL Simulation and Synthesis with PLDs Lab
8	19EC C208	RTOS and VLSI Design Verification Lab
9	19EC C209	Mini Project with Seminar
10	19EC C210	Dissertation /Phase-I
11	19EC C211	Dissertation /Phase-II
Program Elective Courses		
1	19EC E201	Advanced Computer Organization
2	19EC E202	Communication Buses and Interfaces
3	19EC E203	Data Acquisition System Design
4	19EC E204	FPGA & CPLD Architectures
5	19EC E205	Low Power VLSI Design
6	19EC E206	Nano-materials and Nanotechnology
7	19EC E207	Network Security and Cryptography
8	19EC E109	Pattern Recognition and Machine Learning
9	19EC E208	Programming Languages for Embedded Software
10	19EC E209	RF IC Design
11	19EC E210	SoC Design
12	19EC E211	System Design with Embedded Linux
13	19EC E212	VLSI Signal Processing
14	19EC E213	VLSI Technology and Physical Design Automation
15	19EC E114	Wireless Sensor Networks

Mandatory Course		
16	19ME C103	Research Methodology and IPR
S.No	**Course Code**	**Audit Courses**
1	19CE A101	Disaster Management
2	19EG A101	English for Research Paper Writing
3	19EG A102	Indian Constitution and Fundamental Rights
4	19IT A101	Pedagogy Studies
5	19EG A104	Personality Development through Life Enlightenment Skills
6	19EE A101	Sanskrit for Technical Knowledge
7	19EG A103	Stress Management by Yoga
8	19EC A101	Value Education
Open Electives Courses		
1	19CS O101	Business Analytics
2	19ME O103	Composite Materials
3	19CE O101	Cost Management of Engineering Projects
4	19ME O101	Industrial Safety
5	19ME O102	Introduction to Optimization Techniques
6	19EE O101	Waste to Energy

Note: Program Core /Program Elective of one specialization can be Elective for other specialization provided the condition for prerequisite is satisfied. However, a prior permission of the Chairman, BoS is to be obtained.

19EC C201

ANALOG AND DIGITAL CMOS VLSI DESIGN

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisite: Analog and Digital design concepts.

Course Objectives: This course aims to:

1. Characteristic behavior of MOSFET, CMOSFET, FINFET, TFET, Meta Gate Technology
2. Physical design concepts.
3. Design of Analog and digital circuits.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand MOS structure and its fabrication process
2. Design combinational logic circuits and understand physical design flow concepts
3. Discuss advanced technologies and design sequential logic circuits
4. Analyze various analog amplifiers and Current mirrors
5. Illustrate the principles of Basic OPAMP design and compensation techniques.

UNIT-I

Technology Scaling and Road map, Scaling issues, Standard 4 mask NMOS Fabrication process, Review: Basic MOS structure and its static behavior, Stick diagram and Layout, Inverter: Static CMOS inverter, Switching threshold and noise margin concepts and their evaluation of dynamic behavior, Power consumption.

UNIT-II

Physical Design Flow: Floor planning, Placement, Routing, CTS, Power analysis and IR drop estimation-static and dynamic ESD protection-human body model, Machine model, Combinational logic: Static CMOS design, Logic effort, Ratioedlogic, Pass transistor logic, Dynamic logic Speed and power dissipation in dynamic logic Cascading dynamic gates, CMOS transmission gate logic.

UNIT-III

Sequential Logic: Static latches and registers, MUX based latches, Static SR flip-flops, Master-slave edge-triggered register, Dynamic latches and registers, advanced technologies: Giga-scale dilemma, Short channel effects, High–k, Metal Gate Technology.

UNIT-IV

Introduction to Analog Design, Second order effects MOS small signal model, Single Stage Amplifier: Common Source Amplifier, CS Stage with Source Degeneration , Common Drain Amplifier & Common Gate Stage (resistive load) Current Mirrors: Basic Current Mirrors, Cascode Mirrors, Special Current Mirror, Single Stage Amplifier: Common Source Amplifier with Current source load, Triode load , CM Load, Frequency response of CS stage, Source follower, Common gate stage, Gilbert cell.

UNIT-V

MOS Difference Pair (One Stage OPAMP), Operational Amplifiers: Two stage OPAMP, Fully differential amplifiers, Slew rate, PSRR, Compensation of two-stage OPAMP, op-amp based comparator, switched capacitor. Introduction to data converters-specifications.

Text Books:

1. J P Rabaey, A P Chandrakasan, B Nikolic, "Digital Integrated circuits: A design perspective", Prentice Hall electronics and VLSI series, 2nd edition 2003
2. David Johns, Ken Martin, "Analog Integrated Circuit Design", John Wiley & sons. 2004
3. Jacob Baker.R.et.al., "CMOS Circuit Design", IEEE Press, Prentice Hall, India, 2000

Suggested Reading:

1. Paul. R. Gray & Robert G. Major, "Analysis and Design of Analog Integrated Circuits", John Wiley & sons. 2004
2. Kang, S. and Leblebici, Y., "CMOS Digital Integrated Circuits, Analysis and Design", TMH, 3rdEdition 2003
3. BehzadRazavi, "Design of Analog CMOS Integrated Circuits", Tata McGrah Hill. 2002.

19EC C202

EMBEDDED SYSTEM DESIGN USING RTOS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The prior knowledge on the basics of operating systems.

Course Objectives: This course aims to:

1. Understand the basic concepts of the UNIX operating system and POSIX Standards.
2. Know the importance of hard/soft Real-Time Systems and to familiarize the cases for tasks, semaphores, queues, pipes, and event flags.
3. Study the basics of the kernel objects and memory management in VxWorks and to know about real-time applications development tools.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the Unix operating system and shell programming.
2. Know the standards of POSIX and its portability.
3. Illustrate the problems on scheduling in hard and soft real time systems.
4. Demonstrate the in-depth knowledge on Real Time Operating System concepts.
5. Program the real time concepts using VxWorks and know about the software development tools and RTOS comparison.

UNIT-I

Brief Review of UNIX Operating Systems: UNIX KernelFile system concepts of Process Concurrent Execution andInterrupts. Process management – forks & execution. Programming with system calls, Process Scheduling, Shell programming and filters.Portable Operating system Interface (POSIX) IEEE Standard 1003.13 and POSIX real time profile. POSIX versus traditional Unix Signals.Overheads and timing predictability.

UNIT-II

Hard versus Soft Real-Time Systems: Examples, Jobs & Processors, Hard and Soft timing constraints, Hard Real time systems, Sift real time systems. Classical Uniprocessor Scheduling algorithms RMS, Preemptive EDF, Allowing for Preemptive and Exclusion condition.

UNIT-III

Concept of Embedded operating systems, Differences between Traditional OS and RTOS, Real time system concepts, RTOS Kernel & Issues in Multitasking Task Assignment, Task switching, Foreground ISRs and Background Tasks, critical section Reentrant Functions, Inter-process Communication (IPC)IPC through Semaphores, mutex, Mailboxes, Message queues or pipes and Event Flags.

UNIT-IV

VxWorks POSIX Real Time Extensions, timeout features, Task Creation, Semaphores (Binary, Counting), Mutex, Mailbox, Message Queues, Memory Management Virtual to Physical Address Mapping.

UNIT-V

Debugging tools and cross development environment Software Logic analyzes, ICEs. Comparison of RTOS VxWorks, uC/OS-II and RT Linux for Embedded Applications.

Text Books:

1. Jane W.S.Liu,"Real Time Systems", Pearson Education, Asia, 2001.
2. Wind River Systems, "VxWorks Programrs Guide", Wind River Systems Inc.1997.
3. Jean .J.Labrose, "MicroC/OS-II", The CMP Books, 2002.

Suggested Reading:

1. Betchof, D.R., "Programming with POSIX threads", Addison Wesley Longman, 1997.
2. C.M.Krishna and G.Shin, "Real Time Systems", McGraw-Hill Companies Inc., McGraw Hill International Editions, 1997.

19EC C203

MICRO CONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Microprocessor and its interfacing

Course Objectives: This course aims to:

1. Learn about ARM Microcontroller architectural features
2. Understand the ARM 'C' Programming for various applications
3. Study the DSP processor fundamentals and its development tools

Course outcomes: Upon completion of this course, students will be able to:

1. Compare and select ARM processor core based on requirements of embedded application
2. Analyze various features of ARM Cortex-M3 Processor
3. Able to interface various I/O devices to ARM 7 microcontroller
4. Understand the basic architectural needs of Programmable DSPs
5. Apply small applications on DSP processor based platform

UNIT-I

Background of ARM and ARM Architecture: A Brief history, Architecture Versions, Registers, pipeline, exception, interrupts and the vector table; core extensions, introduction to ARM instruction set, Introduction to Thumb instructions, Introduction to ARM C Programming.

UNIT-II

LPC21XX Microcontroller: Salient features of LPC 21xx, Pin description, Architectural Overview. Peripherals:Description of General Purpose Input/Output (GPIO) ports, Pin control Block. Features, Pin description, Register description and operation of PLL, Timers, PWM, Interfacing: LED, Relay, Buzzer, LCD, DAC, DC motor. Communication protocols: Brief overview on I2C, SPI, and CAN.

UNIT-III

ARM Cortex-M3 Processor: The Thumb-2 Technology and Instruction Set Architecture, Programming model- Registers, Operation modes, Exceptions and Interrupts, Vector Tables, Memory Map, Applications.

UNIT-IV

Programmable DSP (P-DSP) Processors: Basic architectural features - VLIW architecture, DSP computational building blocks, Bus and Memory architecture, Address generation unit, speed issues, Fixed and Floating point data paths, Introduction to TI DSP Processor family. Introduction to FPGA based DSP system design.

TMS320C67XX: Features of C67XX Processors, Internal Architecture, Functional units and operation, Data paths, Cross paths, Control Register File.

UNIT-V

TMS320C67XX Assembly Language Instructions: Functional Units and its Instructions, Addressing modes, Fixed point Instructions, Conditional Operations, Parallel Operations, Floating point instructions.

TMS320C67XX Application Development Tools: Code composer studio (CCS), Application programs in C67XX Code development in both C and Assembly language.

Text Books:

1. Joseph Yiu, "The definitive guide to ARM Cortex-M3", Elsevier, 2nd Edition, 2010
2. Andrew N.SLOSS, DomonicSymes, Chris Wright "ARM System Developers Guide-Desisning and optimizing system software" ELSEVIER 1st Edition 2004.
3. Avatar Singh and S. Srinivasan, "Digital Signal Processing Implementations Using DSP Microprocessors", Thomson Brooks, 2004.

Suggested Reading:

1. B. Ventakaramani, M. Bhaskar, "Digital Signal Processes, Architecture Processing and Applications", Tata McGraw Hill, 2002.

19EC C204

VLSI DESIGN VERIFICATION AND TESTING

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Pre-requisite: Knowledge on analog and Digital CMOS VLSI Design, C and C++ Language concepts.

Course Objectives: This course aims to:

1. The concepts of verification and testing.
2. Data types and OOPs concepts.
3. Randomization in System Verilog.

Course Outcomes: Upon completion of this course, students will be able to:

1. Familiarity of front end design and verification techniques and create reusable test environments.
2. Understanding various data types used in System Verilog
3. Demonstrating OOPs concepts
4. Make use of Randomization in System Verilog
5. Verify increasingly complex designs more efficiently and effectively

UNIT-I

Verification Guidelines: Verification Process, Basic test bench functionality, directed testing, Methodology basics, Constrained-Random stimulus, Functional coverage, test bench components, Layered test bench, Building layered test bench, Simulation environment phases, Maximum code reuse, test bench performance.

UNIT-II

Data Types: Built-in data types, Fixed-size arrays, Dynamic arrays, Queues, Associative Arrays, Linked lists, Array methods, Choosing a storage type, Creating new types with typedef, Creating user-defined structures, Type conversion, Enumerated types, Constants strings, Expression width. Proceduralstatements and routines: Procedural statements, tasks, functions and void functions, Routine arguments, returningfrom a routine, local data storage,Time values.

UNIT-III

Basic OOPS: Introduction, think of nouns, Not verbs, your first class, where to define a class, OOP terminology, Creating new objects, Object de-allocation, Using objects, Static variables vs. Global variables, Class methods, Defining methods outside of the class, Scoping rules, Using one class inside another.

UNIT-IV

Connecting the test bench and design: Separating the test bench and design, Interface constructs, Stimulus timing, Interface driving and sampling, connecting it all together, Top-level scope Program Module interactions. System Verilog Assertions, understanding dynamic objects, Copying objects, Public vs. Local, Straying off course building a test bench.

UNIT-V

Randomization: Introduction, What to randomize, Randomization in SystemVerilog, Constraint details solution probabilities, Controlling multiple constraint blocks, Valid constraints, In-line constraints, The pre randomize and postrandomize functions, Random number functions, Constraints tips and techniques, Common randomization problems, Iterative and array constraints, Atomic stimulus generation vs. Scenario generation,Random control, Random number generators, Random device configuration.

Text Books:

1. Chris Spears, "System Verilog for Verification", Springer, 2nd Edition 2006.
2. M. Bushnell and V. D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers 2002.

Suggested Reading:

1. Writing testbenches using System Verilog By Janick Bergeron Edition: illustrated Published by Birkhäuser, 2006 ISBN 0387292217, 9780387292212
2. System Verilog for Verification: A Guide to Learning the Test bench Language Features By Chris Spear Edition: 2, Published by Springer, 2008 ISBN 0387765298, 9780387765297.

19EC C205

ANALOG AND DIGITAL CMOS VLSI DESIGN LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: Analog and Digital design concepts.

Course Objectives: This course aims to:

1. Understand Characteristics behavior of MOSFET.
2. Analyze performance of Differential amplifiers
3. Verify layout of basic digital circuits

Course Outcomes: Upon completion of this course, students will be able to:

1. Define the characteristics of MOSFET and design entry in the tool.
2. Understand the design specs and library files of tool.
3. Apply the concept of theory in the lab implementation.
4. Analyze power and delay calculation from the graphs.
5. Compare performance of different circuits with the simulation results.

List of Experiments:

1. Characteristics of MOSFET.
2. Calculation of rise time and fall time for CMOS inverter.
3. To build a three stage and five stage ring oscillator circuit in 0.18um and 0.13um technology and compare its frequencies and time period.
4. NMOS common source amplifier.
5. Design of Differential Amplifier.
6. Design of Operational Amplifier.
7. Draw the layout of inverter circuit.

Suggested Reading:

1. Cadence Design Systems(Ireland) Ltd., “Cadence manual”, 2013.

19EC C206

MICRO CONTROLLERS AND PROGRAMMABLE DIGITAL SIGNAL PROCESSORS LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: Programming in 'C' and basics of ARM Microcontroller.

Course Objectives: This course aims to:

1. Write the ARM 'C' programming for applications
2. Understand the interfacing of various modules with ARM 7/ ARM Cortex-M3
3. Develop assembly and C Programming for DSP processors.

Course Outcomes: Upon completion of this course, students will be able to:

1. Install, configure and utilize tool sets for developing applications based on ARM processor core
2. Design and develop the ARM 7 based embedded systems for various applications
3. Develop application programs on ARM and DSP development boards both in assembly and in C
4. Design and Implement the digital filters on DSP 6713 processor.
5. Analyze the hardware and software interaction and integration.

List of Assignments:

Part A) Experiments to be carried out on ARM 7/Cortex-M3 development boards

1. Blink an LED with software delay, delay generated using the SysTick timer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.
4. Control an LED using switch by polling method, by interrupt method and flash the LED once every five switch presses.
5. UART Echo Test.
6. Take analog readings on rotation of rotary potentiometer connected to an ADC channel.
7. Temperature indication on an RGB LED.

8. Mimic light intensity sensed by the light sensor by varying the blinking rate of an LED.
9. Evaluate the various sleep modes by putting core in sleep and deep sleep modes.
10. System reset using watchdog timer in case something goes wrong.
11. Sample sound using a microphone and display sound levels on LEDs.

Part B) Experiments to be carried out on DSP C6713 evaluation kits and using Code Composer Studio (CCS)

1. To develop assembly code and study the impact of parallel, serial and mixed execution
2. To develop assembly and C code for implementation of convolution operation
3. To design and implement IIR filters in assembly and in C to enhance the features of given input sequence/signal.
4. To design and implement FIR filters in assembly and in C to enhance the features of given input sequence/signal.

Suggested Reading:

1. Philips semiconductors, "ARM 7 (LPC 214x) user manual", 2005.
2. Vinay K. Ingle and John G. Proakis, "Digital Signal Processing using MATLAB", 4/e, Cengage learning, 2011.
3. B. Venkataramani and M. Bhaskar, "Digital Signal Processor architecture, programming and application", 6/e, TMH, 2006.

19EC C207

RTL SIMULATION AND SYNTHESIS WITH PLDs LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisites: Digital Design,Verilog HDL programming skills.

Course Objectives: This course aims to:

1. The simulation of combinational and sequential circuits.
2. FSM based designs.
3. Implementation of DFT and FFTs.

Course Outcomes: Upon completion of this course, students will be able to:

1. Use computer-aided design tools for design of complex digital logic circuits.
2. Model, simulate, verify with hardware description language (HDL).
3. Simulate and synthesis FSMS.
4. Design Fourier transforms using HDL
5. Design and prototype with programmable logic.

Design entry by Verilog,Programmable Logic Devices, Introduction to ASIC Design Flow, FPGA, SoC, Floor planning, Placement, Clock tree synthesis, Routing, Physical verification, Power analysis, ESD protection. Static Timing analysis, Meta-stability, Clock issues, Need and design strategies for multi-clock domain designs, IP and Prototyping, Design for testability.

List of Experiments:

1. Verilog implementation of 8:1 Mux/Demux, Full Adder, 8-bit Magnitude comparator,
2. Encoder/decoder, Priority encoder, D-FF, 4-bit Shift registers (SISO, SIPO, PISO, Bidirectional) 3-bit Synchronous Counters, Binary to Gray converter, Parity generator.
3. Sequence generator/detectors, Synchronous FSM – Mealy and Moore machines.
4. Vending machines - Traffic Light controller, ATM, elevator control.
5. PCI Bus & arbiter and downloading on FPGA.
6. UART/ USART implementation in Verilog.

7. Realization of single port SRAM in Verilog.
8. Verilog implementation of Arithmetic circuits like serial adder/ subtractor, parallel adder/subtractor, serial/parallel multiplier.
9. Discrete Fourier transform/Fast Fourier Transform algorithm in Verilog.

Suggested Reading:

1. Samir Palnitkar, "Verilog HDL, a guide to digital design and synthesis", Prentice Hall 2003.
2. Doug Amos, Austin Lesea, Rene Richter, "FPGA based prototyping methodology manual", Xilinx, 2011.
3. Bob Zeidman, "Designing with FPGAs & CPLDs", CMP Books, 2002.

19EC C208

RTOS AND VLSI DESIGN VERIFICATION LAB

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Prerequisite: Basics of operating system,basics of embedded system and verification concepts.

Course Objectives: This course aims to:

1. Understand the concepts of RTOS Programming
2. Illustrate the concept of task scheduling
3. Verify layout of basic digital circuits

Course Outcomes: Upon completion of this course, students will be able to:

1. Verify a few important OOPs concepts
2. Compile and Run various design constructs using CAD tool
3. Develop self-checking test benches using SystemVerilog
4. Understand the programming concepts of RTOS
5. To analyze Multitasking IPC and scheduling concepts

RTOS Programming:

1. Introduction to RTOS (VxWorks) and its basic functions
2. RTOS Timer programming (VxWorks)
3. RTOS Task function programming (VxWorks)
4. Multi-tasking using round robin scheduling
5. IPC using message queues
6. IPC using semaphore
7. IPC using mail box

Verification (Mentor Graphics Tools)

1. Sparse memory
2. Semaphore
3. Mail box
4. Classes
5. Polymorphism

6. Coverage
7. Assertions

Suggested Reading:

1. Silberschatz, Galvin, Gange" Operating Systems Concepts" 8/e , Wiley Education, 2007.
2. Wind River SystemsInc., "VxWorks Programrs Guide", 2003.

19EC C209

MINI PROJECT WITH SEMINAR

Instruction	4 P Hours per Week
Duration of SEE	—
SEE	—
CIE	50 Marks
Credits	2

Course Outcomes: Students are able to:

1. Formulate a specific problem and give solution.
2. Develop model/models either theoretical/practical/numerical form.
3. Solve, interpret/correlate the results and discussions.
4. Conclude the results obtained.
5. Write the documentation in standard format.

Guidelines:

- As part of the curriculum in the II- semester of the Program each students shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.
- Each student will be allotted to a faculty supervisor for mentoring.
- Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.
- Mini projects shall have inter disciplinary/ industry relevance.
- The students can select a mathematical modeling based/Experimental investigations or Numerical modeling.
- All the investigations are clearly stated and documented with the reasons/explanations.
- The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, detailed discussion on results, conclusions and references.

Department committee: Supervisor and two faculty coordinators

Guidelines for awarding marks (CIE):		Max. Marks: 50
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	20	Progress and Review
	05	Report
Department Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

19EC C210

DISSERTATION/PHASE-I

Instruction	20 P Hours per Week
Duration of SEE	—
SEE	—
CIE	100 Marks
Credits	10

Course Outcomes: At the end of the course:

1. Students will be exposed to self-learning various topics.
2. Students will learn to survey the literature such as books, National/ International refereed journals and contact resource persons for the selected topic of research.
3. Students will learn to write technical reports.
4. Students will develop oral and written communication skills to present.
5. Student will defend their work in front of technically qualified audience.

Guidelines:

- The Project work will preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution.
- Seminar should be based on the area in which the candidate has undertaken the dissertation work.
- The CIE shall include reviews and the preparation of report consisting of a detailed problem statement and a literature review.
- The preliminary results (if available) of the problem may also be discussed in the report.
- The work has to be presented in front of the committee consists of Head, Chairperson-BoS, Supervisor and Project coordinator.
- The candidate has to be in regular contact with his supervisor and the topic of dissertation must be mutually decided by the guide and student.

Guidelines for the award of Marks:		Max. Marks: 100
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Supervisor	30	Project Status / Review(s)
	20	Report
Department Committee	10	Relevance of the Topic
	10	PPT Preparation(s)
	10	Presentation(s)
	10	Question and Answers
	10	Report Preparation

Note : Department committee has to assess the progress of the student for every two weeks.

19EC C211

DISSERTATION/PHASE-II

Instruction	32 P Hours per Week
Duration of SEE	Viva - Voce
SEE	100 Marks
CIE	100 Marks
Credits	16

Course Outcomes: At the end of the course:

1. Students will be able to use different experimental techniques and will be able to use different software/ computational/analytical tools.
2. Students will be able to design and develop an experimental set up/ equipment/test rig.
3. Students will be able to conduct tests on existing set ups/equipment and draw logical conclusions from the results after analyzing them.
4. Students will be able to either work in a research environment or in an industrial environment.
5. Students will be conversant with technical report writing and will be able to present and convince their topic of study to the engineering community.

Guidelines:

- It is a continuation of Project work started in semester III.
- The student has to submit the report in prescribed format and also present a seminar.
- The dissertation should be presented in standard format as provided by the department.
- The candidate has to prepare a detailed project report consisting of introduction of the problem, problem statement, literature review, objectives of the work, methodology (experimental set up or numerical details as the case may be) of solution and results and discussion.
- The report must bring out the conclusions of the work and future scope for the study. The work has to be presented in front of the examiners panel consisting of an approved external examiner, an internal examiner (HoD and BoS Chair Person) guide/co-guide.
- The candidate has to be in regular contact with his/her guide/co-guide.

Guidelines for awarding marks in CIE:		Max. Marks: 100
Evaluation by	**Max. Marks**	**Evaluation Criteria / Parameter**
Department Review Committee	05	Review 1
	10	Review 2
	10	Review 3
	15	Final presentation with the draft copy of the report reportstandard format
	10	Submission of the report in a standard format
Supervisor	10	Regularity and Punctuality
	10	Work Progress
	10	Quality of the work which may lead to publications
	10	Analytical / Programming / Experimental Skills Preparation
	10	Report preparation in a standard format

Guidelines for awarding marks in SEE: (Max. Marks: 100)

Evaluation by	**Max .Marks**	**Evaluation Criteria / Parameter**
External and Internal Examiner(s) together	20	Power Point Presentation
	40	Quality of thesis and evaluation
	20	Quality of the project ı Innovations ı Applications ı Live Research Projects ı Scope for future study ı Application to society
	20	Viva-Voce

19EC E201

ADVANCED COMPUTER ORGANIZATION

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamentals of Computer architecture.

Course Objectives: This course aims to:

1. Learn about processor design for computer system
2. Understand the memory organization of the computer
3. Study the I/O organization and parallel computer systems

Course Outcomes: Upon completion of this course, students will be able to:

1. Analyze the computer arithmetic operations.
2. Design of control UNIT-of the computer
3. Understand the memory organization of the computer
4. Interface various I/O modules to the computer system
5. Analyze the multiprocessor environment and various buses for the computer system

UNIT– I

Processor Design: CPU Organization, Data Representation, Instruction Formats, Data Path Design: Fixed Point Arithmetic and Floating Point Arithmetic, Instruction Pipelining, Super Scalar techniques, linear pipeline processors, Super scalar and super pipeline design, Multi vector and SIMD computers.

UNIT– II

Control Unit Design: Basic Concepts: Basic control Unit-of the computer system. Hardwired Control UNIT-Design approach,Micro-Programmed Control UNIT-Design Approach, Micro program sequencer, Case studies based on both the approaches.

UNIT-III

Memory Organization: Internal memory, computer memory system overview, the memory Hierarchy, Random access memories, Cache memory, Elements of cache design, Virtual memory- protection and examples of virtual memory, Replacement Policies.

UNIT– IV

I/O Organization: Accessing I/O Devices, Programmed I-O, Interrupts, DMA, Bus Arbitration; Synchronous bus and asynchronous bus, Interface circuits, Parallel port, Serial port, standard I/O interfaces, IO Processor, PCI bus, SCSI bus, USB bus protocols.

UNIT– V

Parallel Computer Systems: Instruction Level Parallelism (ILP) – Concept and Challenges, Dynamic Scheduling, Limitations on ILP,Thread Level Parallelism, Multi-processors – Characteristics, Symmetric and Distributive Shared Memory Architecture, Vector Processors and Supercomputers.

Text Books:

1. Carl Hamacher, Vranesic, Zaky, "Computer Organization", 5th edition, MGH, 2010
2. William Stallings, "Computer Organization and Architecture designing for Performance", 7th edition, PHI, 2007.

Suggested Reading:

1. John L. Hennessy and David A. Patterson, "Computer Architecture", A quantitative Approach, 3rd Edition, Elsevier, 2005.
2. Hayes John P,"Computer Architecture and organization" 3rd Edition, MGH, 1998.

19EC E202

COMMUNICATION BUSES AND INTERFACES

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamentals of Computer organization and architecture.

Course Objectives: This course aims to:

1. Learn about serial communications buses for computer system
2. Understand the CAN and PCI technology
3. Study the importance of the USB bus architecture

Course Outcomes: Upon completion of this course, students will be able to:

1. Select a particular serial bus suitable for a particular application.
2. Develop APIs for configuration, reading and writing data onto serial bus.
3. Design and develop peripherals that can be interfaced to desired serial bus.
4. Understand the CAN architecture and it's applications
5. Analyze USB data transfers and descriptors and the PCI express technology

UNIT-I

Serial Buses: Serial Port Advantages, Limits, Applications, System Components, Formats and Protocols Asynchronous and Synchronous Communications, Data Formats, Flow control.

UNIT-II

Serial COM Ports on PCs: RS232 -Signals, Voltages, Timing Limits, Interface chips; RS485 -Voltage requirements, Speed, Interfacing Options, Applications. SPI - Overview, Data and Control lines, Configuration; I^2C Overview, Protocol, Configuration.

UNIT-III

CAN: Architecture, Layered structure of a CAN node, Message Transfer - Arbitration, Frame types, Bit Stuffing, Applications.

UNIT-IV

PCI Express Technology (PCIe): PCI Express origins, Configuration space and Access Methods, Enumeration Process, Packet Types and Fields, Transaction Ordering, Traffic Classes, Virtual Channels and Arbitration (QoS), Flow Control, ACK/NAK Protocol, Applications

UNIT-V

USB: Evolution, USB Vs Ethernet and IEEE-1394, bus components. USB Transfers: Types of Descriptors, Device endpoints, pipes, streams and message pipes. USB bus states, data encoding and Packet format. Introduction to Serial Front Panel Data Port (SFPDP).

Text Books:

1. Mike Jackson, Ravi Budruk, "PCI Express Technology", Mindshare Press, 1st edition, 2012
2. Jan Axelson, "Serial Port Complete - COM Ports, USB Virtual Com Ports, and Ports for Embedded Systems ", Lakeview Research, 2nd Edition, 2012
3. Jan Axelson, "USB Complete", Penram Publications 3rd edition 2005.

Suggested Reading:

1. Wilfried Voss, "A Comprehensible Guide to Controller Area Network", Copperhill Media Corporation, 2nd Edition, 2005.

19EC E203

DATA ACQUISITION SYSTEM DESIGN

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Cancepts of digital systems and communication systems.

Course Objectives: This course aims to:7

1. Understand the different types of communication interface buses.
2. Familiarize different methods of ADC's and DAC's characteristics, specifications
3. Study the software tools to develop the code and implementation for data acquisition system

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the fundamentals of sensors, transducers and signal conditioning.
2. Know the configuration of computer plugin I/O standalone and distributed loggers controllers.
3. Interface the hardware for acquiring the data through systems.
4. Know the design flow for data acquisition system.
5. Learn the software tools to develop the code and implementation for data acquisition system.

UNIT-I

Fundamentals of Data Acquisition Systems, Sensors and Transducers,Signal conditioning - Introduction, Types of signal conditioning, Classes of signal conditioning, DAQ Hardware, DAQ Software, Communications Cabling, Parameters of a DAQ System.

UNIT-II

Data acquisition system configuration, Computer plug in I/O, Distributed I/O, Stand-alone or distributed loggers/controllers- Introduction, Methods of operation, Stand-alone logger/controller hardware, firmware & software design, Communications hardware interface, Host software, Considerations, internal systems, USB overall structure, PCMCIA card.

UNIT-III

Data Acquisition Systems: Hardware-Introduction, Plug-in DAQ Systems, Converters A/D, Converters D/A, Amplifier, Multiplexer/De multiplexer, Power Management, Timing System, Filtering, Memory Board, Bus Interface.

UNIT-IV

Communication Bus-Bus and FireWire, Serial Communications, Wireless, Ethernet and Bluetooth, GSM for Data Acquisition System, PCI and PCI Express, Standard VME,

UNIT-V

Design of Data Acquisition System: Introduction to the Design, Functional Design of high Speed Computers-Based DAS, Portable DAS, Design Guidelines for High-Performance Multichannel.Software for Data Acquisition SystemsIntroduction,LabVIEW, Android for DAQ, Design of Firmware, Example of Implementation of a Software.

Text Books:

1. Maurizio Di Paolo Emilio "Data acquisition systems-from fundamentals to applied design" springer, 2013.
2. John Park and Steve Mackay "Practical Data acquisition for instrumentation and control systems" Elsevier, 2003.

Suggested Reading:

1. Robert H King, "Introduction to Data Acquisition with LabVIEW", 2nd edition, 2012, McGraw Hill.

19EC E204

FPGA AND CPLD ARCHITECTURES

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge of Digital design using Multiplexers and Look-up tables.

Course Objectives: This course aims to:

1. Study various PLD, CPLDs and FPGA Architectures and its features.
2. Understand the different programming technologies, placement and routing
3. Study the design tools for FPGA and ASICs.

Course Outcomes: Upon completion of this course, students will be able to:

1. Explain the concepts of PLDs, CPLDs and FPGAs.
2. Analyze and compare the various architectures of CPLD and FPGA and its programming technologies.
3. Implement various logic functions on PLDs, CPLDs and FPGAs.
4. Understand the concepts of placement and routing algorithms and classifying ASICs.
5. Demonstrate VLSI tool flow for CPLDs and FPGAs.

UNIT-I

Programmable Logic Devices: Introduction, Evolution: Programmable read only memory (PROM), programmable logic array (PLA) and programmable array logic (PAL). Implementation with PLDs.Programming technologies. Design flow for CPLDs & FPGAs.

UNIT-II

CPLDs: Complex Programmable Logic Devices: Architecture and features of Altera max 7000 series CPLD, AMD Mach 4 and Xilinx 9500 series.

FPGAs: Field Programmable Gate Arrays: Logic blocks, routing architecture and features of Xilinx XC4000, Spartan II, Virtex II and Actel Act1, Act2, Act3 FPGAs.

UNIT-III

Advance FPGAs: Architectures and Features of Xilinx Spartan- 6, Virtex-6, and AlterasStartix FPGAs. Introduction to Xilinx Zynq board.

UNIT-IV

Placement: objectives, placement algorithms: Min-cut-Based placement, Iterative Improvement placement, Simulated Annealing.Routing: objectives, Segmented Channel Routing, Maze Routing, Routability estimation, computing signal delay in RC tree networks.

UNIT-V

Digital Front End and back End tools for FPGAs and ASICs, FPGA implementation steps.Verification: introduction, logic simulation, design validation, timing verification.Testing concepts: failures, mechanisms and faults, fault coverage, ATPG methods and programmability failures.

Text Books:

1. S. Brown, R. Francis, J. Rose, Z.Vransic, "Field Programmable Gate array", BSP,2007.
2. P.K. Chan & S. Mourad, "Digital Design Using Field Programmable Gate Array", Pearson Education 2009.

Suggested Reading:

S. Trimberger, Edr., "Field Programmable Gate Array Technology", Kluwer Academic Publications, 1994.

19EC E205

LOW POWER VLSI DESIGN

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Students should have the prior knowledge ofAnalog and Digital CMOS VLSI Design.

Course Objectives: This course aims to:

1. Know the sources of power dissipation and need for low power designs for emerging technologies..
2. Understand the concepts of Low power design techniques for digital circuits
3. Analyze the power dissipations of memory and processor systems and able to adopt suitable methods for power reduction.

Course Outcomes: Upon completion of this course, students will be able to:

1. Identify the sources of power dissipation in digital IC systems & understand the impact of power on system performance and reliability.
2. Characterize and model power consumption & understand the basic analysis methods.
3. Understand leakage sources and reduction techniques.
4. Interpreting Logic synthesis for low power.
5. Adopt memory and software design for low power.

UNIT-I

Technology & Circuit Design Levels: Sources of power dissipation in digital ICs, degree of freedom, recurring themes in low power, emerging low power approaches, dynamic dissipation in CMOS, effects of Vdd and Vt on speed, constraints on Vt reduction, transistor sizing and optimal gate oxide thickness, impact of technology scaling, technology innovations.

UNIT-II

Low Power Circuit Techniques: Power consumption in circuits, flip-flops and latches, high capacitance nodes, energy recovery, reversible pipelines, high performance approaches.

UNIT-III

Low Power Clock Distribution: Power dissipation in clock distribution, single driver Versus distributed buffers, buffers and device sizing under process variations, zero skew versus Tolerable skew, chip and package co-design of clock network.

UNIT-IV

Logic Synthesis for Low Power Estimation Techniques: Power minimization techniques, Low power arithmetic components circuit design styles, adders, multipliers. Low Power Memory Design: Sources and reduction of power dissipation in memory subsystem, sources of power dissipation in DRAM & SRAM.

UNIT-V

Low Power Microprocessor Design System: power management support, architectural tradeoffs for power, choosing the supply voltage, low-power clocking, implementation problem for low power, comparison of microprocessors for power & performance.

Text Books:

1. P. Rashinkar, Paterson and L. Singh, "Low Power Design Methodologies", Kluwer Academic, 2002
2. Kaushik Roy, Sharat Prasad, "Low power CMOS VLSI circuit design", John Wiley sons, Inc., 2000.

Suggested Reading:

1. J.B.Kulo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley, 1999.
2. Gary Yeap, "Practical low power digital VLSI design", Kluwer, 1998.
3. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer,1995

19EC E206

NANO-MATERIALS AND NANO TECHNOLOGY

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Basic knowledge in Nano Materials and Material Science.

Course Objectives: This course aims to:

1. Describe the basic science behind the properties of materials at the Nanometer scale.
2. Understand the various micro and nano fabrication techniques
3. Characterize Nano Structures and special Nano Materials.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the basic science behind the design and fabrication of nano scale system.
2. Explain the importance of reduction in materials dimensionality, and its relationship with materials properties.
3. Understand and formulate new engineering solutions for current problems and competing technologies for future applications.
4. Gather detailed knowledge of the operation and fabrication of MEMS.
5. Familiarize and design of carbon nanotubes and nano devices.

UNIT-I

Introduction to Nano Materials: Evolution of Nanoscience and technology, Introduction to Nanotechnology, Moores law, Bottom up and Top – down approaches, Introduction to Semiconducting Nano particles, Electrical and optical properties, Superconducting properties, magnetic properties, mechanical properties.

UNIT-II

Applications of Nanomaterials: Molecular Electronics and Nano-electronics, Nanobots,Biological Applications of Nanoparticles, Catalysis by Gold Nanoparticles , Band Gap Engineered Quantum Devices- Quantum well devices, Quantum dot devices, Nano-mechanics, Carbon Nanotube Emitters. Photo-electro-chemical Cells, Photonic Crystals and Plasmon Waveguides, Photonic crystals, Plasmon waveguides.

UNIT-III

Nano Fabrication: Introduction to Micro, Nano fabrication, Lithography, Electron beam lithography, thin film deposition. Nano and Micro-electromechanical systems (NMEMS), Types of MEMS, Fabrication of MEMSassembling and packaging, applications of MEMS.

UNIT-IV

Nano Structures: Carbon Nanotubes and Nano devices-structural design of Nano and MEM actuators and sensors configurations and structural design of motion Nano- and micro- structures.

UNIT-V

Special Nano Materials: Nano Composites- Introduction, Synthesis procedures, various systems (metal polymer and metal ceramics) characterization procedures, applications.

Nano Biomaterials: Introduction, Biocompatibility, applications.

Text Books:

1. Guozhongcao, "Nano Structures and Nano materials: Synthesis, properties and applications", Imperial college press, 2004.
2. Lyschevski, Sergey Edward, "Nano and Microelectro Mechanical Systems", Fundamentals of Nano and micro engineering, CRC Press, 2000.

Suggested Reading:

1. A S Edelstein & R C Cammarata, "Nano Materials: Synthesis, Properties, and Applications", Institute of physics publishing, 1996.

19EC E207

NETWORK SECURITY AND CRYPTOGRAPHY

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Concepts of Data Computer and Communication Networks.

Course Objectives: This course aims to:

1. Understand the concepts of public key and private key cryptography techniques
2. Study about message authentication and digital signature standards
3. Impart the knowledge of system security.

Course Outcomes: Upon completion of this course, students will be able to:

1. Identify and utilize different forms of cryptography techniques.
2. Analyze solutions for effective key management and distribution and conduct cryptanalysis
3. Encrypt and decrypt data using symmetric key and public-key ciphers
4. Incorporate authentication and security in the network applications.
5. Distinguish among different types of threats to the system and handle the same.

UNIT-I

Security: Need, security services, Attacks, OSI Security Architecture, one time passwords, Model for Network security, Classical Encryption Techniques like substitution ciphers, Transposition ciphers, Cryptanalysis of Classical Encryption Techniques

UNIT-II

Private-Key (Symmetric) Cryptography: Block Ciphers, Stream Ciphers, RC4 Stream cipher, Data Encryption Standard (DES), Advanced Encryption Standard (AES), Triple DES, RC5, IDEA, Linear and Differential Cryptanalysis.

UNIT-III

Public-Key (Asymmetric) Cryptography: RSA, Key Distribution and Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography,

Message Authentication Code, hash functions, message digest algorithms: MD4 MD5, Secure Hash algorithm, RIPEMD-160, HMAC.

UNIT-IV

Authentication: IP and Web Security Digital Signatures, Digital Signature Standards, Authentication Protocols, Kerberos, IP security Architecture, Encapsulating Security Payload, Key Management, Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction.

UNIT-V

System Security: Intruders, Intrusion Detection, Password Management, Worms, viruses, Trojans, Virus Countermeasures, Firewalls, Firewall Design Principles, Trusted Systems.

Text Books:

1. William Stallings, "Cryptography and Network Security, Principles and Practices", Pearson Education, 6th Edition, 2013.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security, Private Communicationina Public World", Prentice Hall, 2nd Edition,1995.

Suggested Reading:

1. Stephen Northcutt, LenyZeltser, Scott Winters, Karen Kent, and Ronald W. Ritchey, "Inside Network Perimeter Security", Pearson Education, 2nd Edition, 2005.
2. Richard Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident detection and Response", William Pollock Publisher, 2013.

19EC E109

PATTERN RECOGNITION AND MACHINE LEARNING

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The student should have knowledge of probability and random variables.

Course Objectives: This course aims to:

1. Understand, design and evaluate pattern recognition problems.
2. Design and implement machine learning solutions to classification
3. Evaluate and interpret the results of the algorithms.

Course Outcomes: Upon completion of this course, students will be able to:

1. Implementation of the parametric and linear models for classification.
2. Design neural networks for classification problems.
3. Develop solutions for pattern recognition problems using SVM.
4. Implementation of independent machine learning algorithms.
5. Understand and Implementing unsupervised clustering techniques.

UNIT-I

Introduction to Pattern Recognition: Pattern Recognition Systems, applications, design cycle, learning and adaptation, examples, Probability Distributions, Bayesian Decision Theory- continuous Features, Minimum Error rate classification, Classifiers, Discriminant Functions and Decision Discriminant surfaces, Bayesian Decision Theory- Discrete Features. Maximum-Likelihood and Bayesian parameter estimation: Maximum Likelihood estimation, Bayesian estimation.

UNIT-II

Linear Models: Linear Models for Regression: Linear Basis Function Models, The Bias-Variance Decomposition, Bayesian Linear Regression, Linear Models forClassification: Functions, Probabilistic Generative Models, Probabilistic Discriminative Models, Bayesian Logistic Regression.

UNIT-III

Neural Network: Feed forward operation and classification: Multilayer Networks, back propagation algorithm : Network learning, Training protocols,

Learning Curves, error surfaces, practical techniques for improving back propagation, additional networks and training methods, Adaboost, Deep Learning.

UNIT-IV

Linear Discriminant Functions: Decision surfaces: Two category case and multicategory case, two-category Linearly separable case, , Minimum- squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machines.

UNIT-V

Algorithm Independent Machine Learning: lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers.

Unsupervised Learning and Clustering: k-means clustering, fuzzy k-means clustering, Hierarchical clustering.

Text Books:

1. C.Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
2. Richard O.Duda, Peter E.Hart and David G.Stork, "Pattern Classification", 2nd Edition John Wiley & Sons, 2001.

Suggested Reading:

1. B.Yagnanarayana, Artificial Neural Networks, Prentice Hall, New Delhi, 2007.

19EC E208

PROGRAMMING LANGUAGES FOR EMBEDDED SOFTWARE

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Embedded systems and C programming.

Course Objectives: This course aims to:

1. Introduce students to various programming languages like C, C++, JavaScript, PERL, etc.
2. Distinguish between Procedural and OOP language, Introduce features of OOPs etc.
3. Demonstrate the development of some typical applications using different Programming languages.

Course Outcomes: Upon completion of this course, students will be able to:

1. Write an embedded C application of moderatecomplexity.
2. Develop the Object-Oriented approach to software that models application and Develop algorithms inC++.
3. Elaborate the overloading and Inheritance concepts of programming.
4. Handle the exceptions of the error code.
5. Differentiate interpreted languages from compiled languages.

UNIT-I

Embedded 'C' Programming: Bitwise operations, Dynamic memory allocation, OS services, linked stack and queue, Sparse matrices, Binary tree, Interrupt handling in C, Code optimization issues, Writing LCD drives, LED drivers, Drivers for serial port communication, Embedded Software Development Cycle and Methods (Waterfall, Agile).

UNIT-II

Object Oriented Programming: Introduction to procedural, modular, object-oriented and generic programming techniques, Limitations of procedural programming, objects, classes, data members, methods, data encapsulation, data abstraction and information hiding, inheritance, polymorphism.

UNIT-III

CPP Programming: 'cin', 'cout', formatting and I/O manipulators, new and delete operators, Defining a class, data members and methods, 'this' pointer, constructors, destructors, friend function, dynamic memory allocation.

UNIT-IV

Overloading and Inheritance: Need of operator overloading, overloading the assignment, overloading using friends, type conversions, single inheritance, base and derived classes, friend classes, types of inheritance, hybrid inheritance, multiple inheritance.

Templates: Function template and class template, member function templates and template arguments.

UNIT-V

Exception Handling: syntax for exception handling code: try-catch-throw, Multiple Exceptions.

Scripting Languages: Overview of Scripting Languages PERL, CGI, VB Script, Java Script.

PERL: Operators, Statements Pattern Matching etc. Data Structures, Modules, Objects, Tied Variables, Inter process Communication Threads, Compilation & Line Interfacing.

Text Books:

1. Michael J. Pont , "Embedded C", Pearson Education, 2nd Edition,2008
2. Robert Sedgewick, "Algorithms in C++", Addison Wesley Publishing Company, 1999.

Suggested Reading:

1. Randal L. Schwartz, "Learning Perl", O'Reilly Publications, 6th Edition 2011
2. A. Michael Berman, "Data structures via C++", Oxford University Press, 2002.

19EC E209

RF IC DESIGN
(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Knowledge onNetwork Theory, Analog Electronics and CMOS VLSI.

Course Objectives: This course aims to:

1. Introduce students the concept of tuned circuit, matching network, reflection coefficients, transmission lines, and MOS high frequency behavior etc.
2. Demonstrate design of High Frequency Amplifiers.
3. Introduce various types of Power Amplifiers and PLLs

Course Outcomes: Upon completion of this course, students will be able to:

1. Define the characteristics RF systems, Tuned circuits, LNA, Mixers
2. Understand the behavior of RF systems, Reflection Coefficient and Noise in the MOS device
3. Apply the concepts noise and to characterize the amplifiers
4. Analyze different Power Amplifiers at RF range Compare different LNA Configuration, Power Amplifiers
5. Design, Develop and Improve the performance of LNA, Power amplifier, PLL.

UNIT-I

RF Tuned Circuits: RF systems Basic architectures, Maximum Power Transfer, Passive RLC Networks, Parallel RLC tank, Q , Series RLC networks, matching, Pi match, T match, Passive components in IC: Resistors, capacitors, Inductors, Transceiver Architectures.

UNIT-II

Nonlinearity and Reflection Coefficient: Nonlinearity and Time Variance of system, sensitivity and dynamic range, Review of MOS Device Physics, MOS device review, Distributed Systems ,Transmission lines, reflection coefficient, The wave equation Lossy transmission lines Smith charts – plotting gamma, Noise in FET: Thermal noise, flicker noise review.

UNIT-III

High Frequency Amplifier Design: High Frequency Amplifier Design: Bandwidth estimation using open-circuit time constants, Bandwidth estimation using short-circuit time constants, Rise-time, delay and bandwidth, Zeros to enhance bandwidth, Shunt-series amplifiers, tuned amplifiers Cascaded amplifiers, Noise figure, Intrinsic MOS noise parameters, LNA Design , Power match versus noise match.

UNIT-IV

RF Power Amplifiers: Multiplier based mixers, Subsampling mixers & Mixer Design, RF Power Large signal performance Amplifiers, Class A,AB,B, C amplifiers, Class D,E, F amplifiers RF Power amplifier design issues.

UNIT-V

PLL: Voltage controlled oscillators, Resonators , Negative resistance oscillators, Phase locked loops Linearized PLL models , Phase detectors, charge pumps, Loop filters, PLL design examples, Frequency synthesis and oscillator Frequency division, integer-N synthesis , Fractional frequency synthesis, Phase noise.

Text Books:

1. Thomas H. Lee, "The Design of CMOS Radio-Frequency Integrated Circuits", Cambridge University Press, 2004.
2. Behzad Razavi, "RF Microelectronics", Prentice Hall, 1997.

Suggested Reading :

1. Abidi, P.R. Gray, and R.G. Meyer, eds., "Integrated Circuits for Wireless Communications", New York: IEEE Press, 1999.
2. R. Ludwig and P. Bretchko, "RF Circuit Design, Theory and Applications", Pearson, 2000.

19EC E210

SoC DESIGN
(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Concept of Embedded Systems, Microprocessors, microcontrollers and ASIC.

Course Objectives: This course aims to:

1. Introduce students to various approaches of SoC design, ADLs and GNR.
2. Introduce various techniques used for Low power SoC Design
3. Demonstrate various simulation methods and synthesis techniques for SoCs.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the concepts related to SoC like NISC, ASIP,ADL, GNR, Reconfiguration, Clock Gating, DVS etc.
2. Differentiate between various design strategies like ASIC and SOC etc.
3. Differentiate between various types of Processors like CISC, RISC, NISC and ASIP.HDL and ADL
4. Design a simple SOC for reconfigurability / low power / ASIP / NISC etc. and synthesize simple blocks using Graph Theory.
5. Simulate and synthesize the Design using various simulation models.

UNIT-1

ASIC and NISC Overview : Overview of ASIC types, design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application Specific Instruction Processor (ASIP) concepts, NISC-NISC Control Words methodology, NISC Applications and Advantages.

UNIT-2

ADL (for ASIP and NISC) and GNR: Architecture Description Languages (ADL) for design and verification of Application Specific Instruction-set Processors (ASIP), (NISC)-design flow, modeling NISC architectures and systems,Generic

Netlist Representation -A formal language for specification, compilation and synthesis of embedded processors.

UNIT-3

Low Power SoC Design: Low power SoC design / Digital system, Low power system perspective-power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequency and voltage scaling (DCFS), building block optimization, power down techniques, power consumption verification.

UNIT-4

Simulation: Different simulation modes, behavioural, functional, static timing, gate level, switch level, transistor/circuit simulation, design of verification vectors.FPGA, Reconfigurable systems, SoC related modeling of data path design and control logic, Minimization of interconnects impact, clock tree design issues.

UNIT-5

Synthesis: Role and Concept of graph theory and its relevance to synthesizable constructs, Walks, trails paths, connectivity, components, mapping/visualization, nodal and admittance graph. Technology independent and technology dependent approaches for synthesis, optimization constraints, Synthesis report analysis. HDL coding techniques for minimization of power consumption.Design of NISC for DCT application.

Text Books:

1. Michael J. Flynn and Wayne Luk, "Computer System Design: System-on-Chip". Wiley, 2011.
2. B. Al Hashimi, "System on chip-Next generation electronics", The IET, 2006.

Suggested Reading:

1. Hubert Kaeslin, "Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication", Cambridge University Press, 2008.
2. RochitRajsuman, "System-on- a-chip: Design and test", Advantest America R & D Center, 2000.
3. P Mishra and N Dutt, "Processor Description Languages", Morgan Kaufmann, 2008.

19EC E211

SYSTEM DESIGN WITH EMBEDDED LINUX

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Fundamentals of Computer organization and architecture, Embedded Systems.

Course Objectives: This course aims to:

1. Introduce student to the need of Embedded Linux and to Differentiate between Desktop and Embedded Linux.
2. Introduce students to different Board support packages and Divers for Embedded Linux
3. Demonstrate Embedded Linux development cycle and use of Memory Management.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the importance of Embedded Linux in system design.
2. Familiarize with Embedded Linux development model.
3. Analyze the architecture of Embedded Linux in detail.
4. Explain the Linux BSP for a hardware platform.
5. Develop and Debug the drivers in Embedded Linux.
6. Understand the concepts of Embedded Graphics and μClinux.

UNIT-I

Introduction: Need of Embedded Linux, Embedded Linux versus Desktop Linux, Embedded Linux Distributions Embedded Linux Architecture, Kernel Architecture: Hardware Abstraction Layer (HAL), Memory Manager, Scheduler, File System, IO Subsystem, Networking Subsystems, IPC; User Space, Linux Start-Up Sequence.

UNIT-II

Board Support Package: Inserting BSP in Kernel Build Procedure, The Boot Loader Interface, Memory Map, Interrupt Management, The PCI Subsystem, Timers, UART, Power ManagementEmbedded Storage: Flash Map, Memory Technology Device, MTD Architecture, Embedded File Systems.

UNIT-III

Embedded Drivers: Linux Serial Driver, Ethernet Driver, I2C Subsystem on Linux, USB Gadgets, Watchdog Timer, Kernel ModulesPorting Applications: Architectural Comparison, Application Porting Roadmap.

UNIT-IV

Real-Time Linux: Linux and Real-Time: Building and Debugging: Building the Kernel, Building the Root File System, Integrated Development Environment, Elementary Concepts of DebuggingEmbedded Graphics: Graphics System, Introduction to Display Hardware.

UNIT-V

µClinux: Linux on MMU Less Systems, Program Load and Execution, Memory Management, File / Memory Mapping.

Text Books:

1. Derek Molloy, "Exploring Beagle Bone: Tools and Techniques for Building with Embedded Linux", Wiley, 1st Edition, 2014.
2. Christopher Hallinan, "Embedded Linux Primer: A Practical Real-World Approach", Prentice Hall, 2nd Edition, 2010.

Suggested Reading:

1. P Raghvan, Amol Lad, SriramNeelakandan, "EmbededdEmbedded Linux System Design and Development", Auerbach Publications, 2005.
2. KarimYaghmour, "Building Linux Systems", O'Reilly & Associates, 2008.

19EC E212

VLSI SIGNAL PROCESSING

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: VLSI Design, signals and systems and DSP concepts.

Course Objectives: This course aims to:

1. Understand fundamentals of DSP systems
2. Impart the knowledge of Pipelined and parallel recursive and adaptive filters
3. Analyze the Systolic architecture design concepts

Course Outcomes: Upon completion of this course, students will be able to:

1. Concrete the fundamentals of DSP algorithms.
2. Understand retiming techniques in the context of digital filters.
3. Demonstrate the concepts of systolic array design methodology.
4. Classify various convolution algorithms for programmable hardware.
5. Evaluate pipelining and parallel processing techniques in design of recursive digital filters and Compiling evolution of DSP processors.

UNIT-I

Introduction to DSP systems, Typical DSP algorithms, DSP Application Demands and scaled CMOS technologies**:** Iteration Bound- Data Flow Graph representations, Loop bound and Iteration bound, algorithm for computing iteration bound, iteration bound of multi-rate Data Flow Graph.

UNIT-II

Retiming Definitions and properties, solving systems of inequalities, Retiming techniques, Unfolding-Algorithm, properties, critical path, application. Algorithmic strength reduction in filters andTransforms-Parallel FIR filters, DCT and inverse DCT, Parallel architectures for rank order filters.

UNIT-III

Systolic Architecture Design: Systolic array design methodology, FIR Systolic Arrays, Selection of scheduling vector, Matrix –Matrix Multiplication and 2D-Systolic Array design, Systolic design for space Representations containing

delays.Fast convolution: Cook-Toom Algorithm, Winograd-Algorithm, Iterated convolution, cyclic convolution, design of fast convolution algorithm by inspection.

UNIT-IV

Pipelined, Parallel Recursive and Adaptive Filters: Pipeline interleaving, parallel processing and combined, Scaling and round off noise- computation.Digital lattice filter structures, Bit level arithmetic, architecture, redundant arithmetic.

UNIT-V

Numerical strength reduction, synchronous, wave and asynchronous pipelines, Programmable digit signal processors.

Text Books:

1. Keshab K. Parthi, "VLSI Digital signal processing systems, design and implementation", Wiley, Inter Science, 1999.
2. Mohammad Isamail and Terri Fiez, "Analog VLSI signal and information processing", McGraw Hill, 1994
3. S.Y. Kung, H.J. White House, T. Kailath, "VLSI and Modern Signal Processing", Prentice, Hall, 1985.

Suggested Reading:

1. U. Meyer -Baese, Digital Signal Processing with FPGAs, Springer, 2004.

19EC E213

VLSI TECHNOLOGY AND PHYSICAL DESIGN AUTOMATION

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: Basic knowledge on semiconductor physics and MOS transistors followed by analog and digital fundamentals is required.

Course Objectives: This course aims to:

1. Model passive and active devices suiting advances in IC fabrication technology.
2. Create learning, development and testing environment to meet ever challenging needs in the field of Chip Design.
3. Communicate effectively and convey ideas using innovative engineering using appropriate EDA tools

Course outcomes: Upon completion of this course, students will be able to:

1. Understanding of various fabrication process steps of VLSI technology.
2. Study automation process for VLSI system design.
3. Fundamentals of VLSI Layout and design rules.
4. Demonstrate knowledge of combinational optimization techniques.
5. Understanding of fundamentals for various physical design CAD tools.

UNIT-I

Introduction to VLSI Technology and Fabrication Process: Various layers of IC, wafer preparation and crystal growth, Oxidation, CVD, Lithography, Etching, Ion implantation, diffusion techniques.

UNIT-II

Concepts and Scope of Physical Design: Typical structures of passive and active components, CMOS fabrication process- n-Well, P-Well and Twin Tub,CMOS parasitic- Latch-up and its prevention.

UNIT-III

Cell Concepts and Design Rules: Cell based layout design, fabrication errors, alignment sequence and alignment inaccuracy, Interconnects, contacts,vias, SCMOS design rules, lambda based design rules, stick diagrams, Hierarchical stick diagrams, layouts.

UNIT-IV

General Purpose Methods for Combinational Optimization:Partitioning, placement, discrete methods of global and local placements, routing, local and Global routing viaminimization, over the cell routing, single layer and two layer routing, clock and powerrouting.

UNIT-V;

EDA/CAD Tools: Layout editors, circuit extractors, automatic layout tools, modeling and extraction of circuit Parametersfrom physical layout, compaction, algorithms, physical automations of FPGAs.

Text Books:

1. J.D.Plummer, M.D.Deal and P.B.Griffin, "The Silicon VLSI Technology Fundamentals", Practice and modeling, Pearson Education 2009.
2. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation", 2002.

Suggested Reading:

1. Modern VLSI Design (System on Chip), Woyne Wolf, Pearson Education, 2002.
2. S.H. Gerez, "Algorithms for VLSI Design Automation", 1998.

19EC E114

WIRELESS SENSOR NETWORKS

(Program Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Prerequisite: The knowledge of Wireless/Mobile communications is essential.

Course Objectives: This course aims to:

1. Understanding of Sensor node architecture with hardware and software details for data storage and data dissemination.
2. Familiarization of sensor network protocols such as network based and cluster based protocols.
3. Analysis of issues pertaining to connectivity, coverage and security in a WSN.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the hardware details of different types of sensors and select right type of sensors for various applications.
2. Understand radio standards and communication protocols to be used for wireless sensor Network based systems and application.
3. Use operating systems and programming languages for wireless sensor nodes' performance.
4. Handle special issues related to sensor networks like connectivity, coverage, energy conservation and security challenges.
5. Design wireless sensor network system for different applications under consideration.

UNIT-I

Introduction and overview of sensor network architecture and its applications, Sensor Network comparison with Ad-Hoc Networks, Sensor node architecture with hardware and software details. Data dissemination and processing; differences compared with other database management systems, data storage; query processing.

UNIT-II

Hardware: Examples like mica2, mica-Z, telos-B, cricket, Imote2, T-node, Bt-node, and Sun SPOT, Software (Operating Systems): tiny OS, MANTIS, Contiki, and Ret-OS.

UNIT-III

Programming Tools: C, net-C. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (NS-2) and commercial

UNIT-IV

Overview of Sensor Network Protocols(details of at least 2 important protocols per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, Bluetooth low energy (BLE), UWB.

UNIT-V

Specialized Features of WSN: Energy preservation and efficiency; security challenges; fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

Text Books:

1. F. Zhao and L. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Indian reprint, 2013.
2. H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012.

Suggested Reading:

1. C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, "Wireless Sensor Networks", Springer Verlag, 1st Indian reprint, 2010.
2. YingshuLi, MyT. Thai, Weili Wu, "Wireless sensor Network and Applications", Springer series on signals and communication technology, 2008.

19ME C103

RESEARCH METHODOLOGY AND IPR

(Mandatory Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	25 Marks
Credits	2

Course Objectives: This course aims to:

1. Motivate to choose research as career
2. Formulate the research problem, prepare the research design
3. Identify various sources for literature review and data collection report writing
4. Equip with good methods to analyze the collected data
5. Know about IPR copyrights

Course Outcomes: Upon completion of this course, students will be able to:

1. Define research problem, review and asses the quality of literature from various sources
2. Improve the style and format of writing a report for technical paper/ Journal report, understand and develop various research designs
3. Collect the data by various methods: observation, interview, questionnaires
4. Analyze problem by statistical techniques: ANOVA, F-test, Chi-square
5. Understand apply for patent and copyrights

UNIT-I

Research Methodology: Research Methodology: Objectives and Motivation of Research, Types of Research, research approaches, Significance of Research, Research Methods verses Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Selection of Research Problem, Necessity of Defining the Problem

UNIT-II

Literature Survey Report Writing: Literature Survey: Importance and purpose of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Report writing: Meaning of interpretation, layout of research report, Types of reports, Mechanics of writing

a report. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

UNIT-III

Research Design: Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Steps in sample design, types of sample designs.

UNIT-IV

Data Collection and Analysis: Data Collection: Methods of data collection, importance of Parametric, non parametric test, testing of variance of two normal population, use of Chi-square, ANOVA, Ftest, z-test

UNIT-V

Patents and Copyright: Patent: Macro economic impact of the patent system, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights? Enforcement of Intellectual Property Rights: Infringement of intellectual property rights, Case studies of patents and IP Protection

Text Books:

1. C.R Kothari, "Research Methodology, Methods & Technique"; New Age International Publishers, 2004
2. R. Ganesan, "Research Methodology for Engineers", MJP Publishers, 2011
3. Y.P. Agarwal, "Statistical Methods: Concepts, Application and Computation", Sterling Publs., Pvt., Ltd., New Delhi, 2004

Suggested Reading:

1. AjitParulekar and Sarita D' Souza, "Indian Patents Law – Legal & Business Implications"; Macmillan India ltd , 2006
2. B. L.Wadehra; "Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications"; Universal law Publishing Pvt. Ltd., India 2000.
3. P. Narayanan; "Law of Copyright and Industrial Designs"; Eastern law House, Delhi 2010.

19CE A101

DISASTER MANAGEMENT

(Audit Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. Equip the students with the basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts
2. Impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters
3. Enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters
4. Enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.
5. Equip the students with the knowledge of the chronological phases ina disaster management cycle and to create awareness about the disaster management framework and legislations in the context of national and global conventions

Course Outcomes: Upon completion of this course, students will be able to:

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at different levels
2. Ability to understand and choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan
3. Ability to understand various mechanisms and consequences of human induced disasters for the participatory role of engineers in disaster management
4. Understand the impact on various elements affected by the disaster and to suggest and apply appropriate measures for the same
5. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans and ability to understand various

participatory approaches/strategies and their application in disaster management

UNIT-I

Introduction: Basic definitions- Hazard, Disaster, Vulnerability, Risk, Resilience, Mitigation, Management; classification of types of disaster- Natural and man-made; International Decade for natural disaster reduction (IDNDR); International strategy for disaster reduction (ISDR), National disaster management authority (NDMA).

UNIT-II

Natural Disasters: Hydro meteorological disasters: Causes, Early warning systems- monitoring and management, structural and non-structural measures for floods, drought and Tropical cyclones; Geographical based disasters: Tsunami generation, causes, zoning, Early warning systems- monitoring and management, structural and non-structural mitigation measures for earthquakes, tsunami, landslides, avalanches and forest fires. Case studies related to various hydro meteorological and geographical based disasters.

UNIT-III

Human Induced Hazards: Chemical disaster- Causes, impacts and mitigation measures for chemical accidents, Risks and control measures in a chemical industry, chemical disaster management; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents, traffic accidents, oil spills and stampedes, disasters due to double cellar construction in multi-storied buildings.

UNIT-IV

Disaster Impacts: Disaster impacts- environmental, physical, social, ecological, economical, political, etc.; health, psycho-social issues; demographic aspects-gender, age, special needs; hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-V

Concept of Disaster Management: Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; risk analysis, vulnerability and capacity assessment; Post-disaster environmental response-water, sanitation, food safety, waste management, disease control; Roles and responsibilities of government, community, local institutions, NGOs and other

stakeholders; Policies and legislation for disaster risk reduction, DRR Programs in India and the activities of National Disaster Management Authority.

Text Books:

1. Pradeep Sahni," Disaster Risk Reduction in South Asia", Prentice Hall, 2003.
2. B. K. Singh," Handbook of Disaster Management: techniques & Guidelines", Rajat Publication, 2008.

Suggested Reading:

1. Ministry of Home Affairs". Government of India, "National disaster management plan, Part I and II",
2. K. K. Ghosh," Disaster Management", APH Publishing Corporation, 2006.
3. http://www.indiaenvironmentportal.org.in/files/file disaster_management_india1.pdf
4. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs)
5. Hazards, Disasters and your community: A booklet for students and the community, Ministry of home affairs.

19EGA101

ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. Understand the nuances of language and vocabulary in writing a ResearchPaper.
2. Develop the content, structure and format of writing a research paper.
3. Enable the students to produce original research papers without plagiarism.

Course Outcomes: Upon completion of this course, students will be able to:

1. Interpret the nuances of research paper writing.
2. Differentiate the research paper format and citation of sources.
3. Review the research papers and articles in a scientific manner.
4. Avoid plagiarism and be able to develop their writing skills in presenting the researchwork.
5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT-I

Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits – Limitations – outcomes.

UNIT-II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings – Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation ofsources.

UNIT-III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT-IV

Process of Writing a Research Paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft–Revising/Editing - The final draft and proof reading.

UNIT-V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journalpublications – Advantages/Benefits

Text Books:

1. C. R Kothari, Gaurav, Garg, Research Methodology Methods and Techniques**,** New Age International Publishers. 4th Edition.

Suggested Reading:

1. Day R "How to Write and Publish a Scientific Paper", Cambridge University Press, 2006.
2. MLA "Hand book for writers of Research Papers", East West Press Pvt. Ltd, New Delhi, 7th Edition.
3. Lauri Rozakis, Schaum's, "Quick Guide to Writing Great Research Papers", Tata McGraw Hills Pvt. Ltd, NewDelhi.

Online Resources:

1. NPTEL:https://onlinecourses.nptel.ac.in/noc18_mg13/preview

19EGA102

INDIAN CONSTITUTION AND FUNDAMENTAL RIGHTS

(Audit Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. The history of Indian Constitution and its role in the Indian democracy.
2. Address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement. to civil and economic rights as well as the emergence of nationhood in the early years of Indiannationalism.
3. Have knowledge of the various Organs of Governance and Local Administration.

Course Outcomes: Upon completion of this course, students will be able to:

1. Understand the making of the Indian Constitution and its features.
2. Understand the Rights of equality, the Right of freedom and the Right to constitutionalremedies.
3. Have an insight into various Organs of Governance - composition and functions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operativeSocieties.
5. Understand Electoral Process, specialprovisions.

UNIT-I

History of Making of the Indian Constitutions: History, Drafting Committee (Composition &Working).

Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II

Contours of Constitutional Rights and Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III

Organs of Governance: Parliament: Composition, Qualifications, Powers and Functions

Union executives : President, Governor, Council of Ministers, Judiciary, appointment and transfer of judges, qualifications, powers and functions

UNIT-IV

Local Administration: District's Administration head: Role and importance. Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Panchayati Raj: Introduction, PRIZilla Panchayat, Elected Officials and their roles, CEO Zilla Panchayat: positions and role.

Block level: Organizational Hierarchy (Different departments) Village level: role of elected and appointed officials. Importance of grass root democracy.

UNIT-V

Election Commission: Election Commission: Role and functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and functioning. Institute and Bodies for the welfare of SC/ST/OBC and women**.**

Text Books:

1. The Constitution of India, 1950 (Bare Act), GovernmentPublication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar, Framing of Indian Constitution, 1st Edition,2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis,2015.

Online Resources:

1. http://www.nptel.ac.in/courses/103107084/Script.pdf

19IT A101

PEDAGOGY STUDIES
(Audit Course)

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. Present the basic concepts of design and policies of pedagogy studies.
2. Provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design and assessment practices.
3. Familiarize various theories of learning and their connection to teaching practice.
4. Create awareness about the practices followed by DFID, other agencies and other researchers.
5. Provide understanding of critical evidence gaps that guides the professional development.

Course Outcomes: Upon completing this course, students will be able to:

1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms.
2. Examine the effectiveness of pedagogical practices.
3. Understand the concept, characteristics and types of educational research and perspectives of research.
4. Describe the role of classroom practices, curriculum and barriers to learning.
5. Understand Research gaps and learn the future directions.

UNIT-I

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT-II

Thematic Overview: Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices: Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development: alignment with classroom practices and follow up support - Support from the head teacher and the community – Curriculum and assessment - Barriers to learning: Limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions: Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment – Dissemination and research impact.

Text Books:

1. Ackers J, Hardman F, "Classroom Interaction in Kenyan Primary Schools, Compare", 31 (2): 245 – 261, 2001.
2. Agarwal M, "Curricular Reform in Schools: The importance of evaluation", Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.

Suggested Reading:

1. Akyeampong K, "Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER)", Country Report 1.London: DFID, 2003.
2. Akyeampong K, Lussier K, Pryor J, Westbrook J, "Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count?, International Journal Educational Development, 33 (3): 272- 282, 2013.
3. Alexander R J, "Culture and Pedagogy: International Comparisons in Primary Education", Oxford and Boston: Blackwell, 2001.
4. Chavan M, "Read India: A mass scale, rapid, 'learning to read' campaign", 2003.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc17_ge03/preview
2. www.pratham.org/images/resources%20working%20paper%202.pdf.

19EGA104

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

(Audit Course)

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. Learn to achieve the highest goal happily.
2. Become a person with stable mind, pleasing personality and determination.
3. Awaken wisdom among themselves.

Course Outcomes: Upon completing this course, students will be able to:

1. Develop their personality and achieve their highest goal oflife.
2. Lead the nation and mankind to peace andprosperity.
3. To practice emotional self regulation.
4. Develop a positive approach to work and duties.
5. Develop a versatilepersonality.

UNIT-I

Neetisatakam – Holistic Development of Personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT-II

Neetisatakam – Holistic Development of Personality (cont'd) - Verses 52, 53, 59 (dont's) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT-III

Introduction to Bhagavad Geetha for Personality Development - Shrimad Bhagawad Geeta: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35-Chapter6–Verses5,13,17,23,35-Chapter18–Verses45, 46, 48Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT-IV

Statements of Basic Knowledge - Shrimad Bhagawad Geeta: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from ShrimadBhagawat Geeta.

UNIT-V

Role of Bhagavad Geeta in the Present Scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

Text Books:

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi

Suggested Reading:

1. NTPEL: http://nptel.ac.in/downloads/109104115/

19EE A101

SANSKRIT FOR TECHNICAL KNOWLEDGE

(Audit Course)

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. Get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects
3. Explore the huge knowledge from ancient Indian literature

Course Outcomes: Upon completing this course, students will be able to:

1. Develop passion towards Sanskrit language
2. Decipher the latent engineering principles from Sanskrit literature
3. Correlates the technological concepts with the ancient Sanskrit history.
4. Develop knowledge for the technological progress
5. Explore the avenue for research in engineering with aid of Sanskrit

UNIT-I

Introduction to Sanskrit Language: Sanskrit Alphabets-vowels-consonants-significance of Amarakosa-parts of speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive voice-Past/Present/Future Tense-syntax-Simple Sentences (elementary treatment only)

UNIT-II

Role of Sanskrit in Basic Sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba_sutram or baudhayana theorem (origination of pythogorous theorem)-value of pie-Madhava's sine and cosine theory (origination of Taylor's series).
The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of michealson and morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering): Building construction-soil testing-mortar-town planning-Machine

definition-crucible-furnace-air blower- Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingala chandasutram (origination of digital logic system)

UNIT-IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words-analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants-plants, the living-plants have senses-classification of living creatures

Chemical laboratory location and layout-equipment-distillation vessel-kosthiyanthram-

Text Books:

1. M Krishnamachariar, History of Classical Sanskrit Literature, TTD Press, 1937.
2. M.R. Kale, A Higher Sanskrit Grammar: For the Use of School and College Students, Motilal Banarsidass Publishers, ISBN-13: 978-8120801783, 2015
3. Kapail Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN-10: 8171880649, 1994.
4. Pride of India, Samskrita Bharati Publisher, ISBN: 81-87276-27-4, 2007
5. Shri Rama Verma, Vedas the source of ultimate science, Nag publishers, ISBN:81-7081-618-1, 2005

19EG A103

STRESS MANAGEMENT BY YOGA

(Audit Course)

Instruction	2 L Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to:

1. Creating awareness about different types of stress and the role of yoga in the management ofstress.
2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social andspiritual).
3. Prevention of stress related health problems by yogapractice.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand yoga and its benefits.
2. Enhance Physical strength andflexibility.
3. Learn to relax andfocus.
4. Relieve physical and mentaltension through asanas
5. Improve work performance andefficiency.

UNIT-I

Meaning and Definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT–II

Meaning and Definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT-III

Concept of Stress According to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress.

UNIT-IV

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar

UNIT-V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama.

Meditation Techniques: Om Meditation - Cyclic meditation : Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

Text Books:

1. "Yogic Asanas for Group Training - Part-I": Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. "Rajayoga or Conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata.
3. Nagendra H.R nadNagaratna R, "Yoga Perspective in Stress Management", Bangalore, Swami Vivekananda Yoga Prakashan

Suggested Reading:

1. https://onlinecourses.nptel.ac.in/noc16_ge04/preview
2. https://freevideolectures.com/course/3539/indian-philosophy/11

19EC A101

VALUE EDUCATION
(Audit Course)

Instruction	2 P Hours per Week
Duration of SEE	2 Hours
SEE	50 Marks
CIE	—
Credits	Non Credit

Course Objectives: This course aims to

1. Understand the need and importance of Values for self-development and for National development.
2. Imbibe good human values and Morals
3. Cultivate individual and National character.

Course outcomes: After completion of the Course, Students will be able to

1. Gain necessary Knowledge for self-development
2. Learn the importance of Human values and their application in day to day professional life.
3. Appreciate the need and importance of interpersonal skills for successful career and social life
4. Emphasize the role of personal and social responsibility of an individual for all-round growth.
5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood.

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behaviour, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-Management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual Outlook and Social Values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, Avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books : Self-management and Good health; **and internal & external Cleanliness,** Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish; Satwic, Rajasic and Tamasicgunas.

Text Books:

1. Chakroborty, S.K. "Values & Ethics for organizations Theory and practice", Oxford University Press, New Delhi, 1998.
2. Jaya DayalGoyandaka, "Srimad Bhagavad Gita", withSanskrit Text, Word meaning and Prose meaning, Gita Press, Gorakhpur, 2017.

19CS O101

BUSINESS ANALYTICS

(Open Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Understanding the basic concepts of business analytics and applications
2. Study various business analytics methods including predictive, prescriptive and prescriptive analytics
3. Prepare the students to model business data using various data mining, decision making methods

Course Outcomes: Upon completing this course, students will be able to:

1. To understand the basic concepts of business analytics
2. Identify the application of business analytics and use tools to analyze business data
3. Become familiar with various metrics, measures used in business analytics
4. Illustrate various descriptive, predictive and prescriptive methods and techniques
5. Model the business data using various business analytical methods and techniques

UNIT-I

Introduction to Business Analytics: Introduction to Business Analytics, need and science of data driven (DD) decision making, Descriptive, predictive, prescriptive analytics and techniques, Big data analytics, Web and Social media analytics, Machine Learning algorithms, framework for decision making, challenges in DD decision making and future.

UNIT-II

Descriptive Analytics: Introduction, data types and scales, types of measurement scales, population and samples, measures of central tendency, percentile, decile and quadrille, measures of variation, measures of shape-skewness, data visualization

UNIT-III

Forecasting Techniques: Introduction, time-series data and components, forecasting accuracy, moving average method, single exponential smoothing, Holt's method, Holt-Winter model, Croston's forecasting method, regression model for forecasting, Auto regression models, auto-regressive moving process, ARIMA, Theil's coefficient

UNIT-IV

Decision Trees: CHAID, Classification and Regression tree, splitting criteria, Ensemble and method and random forest. **Clustering**: Distance and similarity measures used in clustering, Clustering algorithms, K-Means and Hierarchical algorithms, **Prescriptive Analytics**- Linear Programming(LP) and LP model building,

UNIT-V

Six Sigma: Introduction, introduction, origin, 3-Sigma Vs Six-Sigma process, cost of poor quality, sigma score, industry applications, six sigma measures, DPMO, yield, sigma score, DMAIC methodology, Six Sigma toolbox

Text Books:

1. U Dinesh Kumar, "Data Analytics", Wiley Publications, 1st Edition, 2017
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles, Concepts, and Applications with SAS", Associate Publishers, 2015.

Suggested Reading:

1. S. Christian Albright, Wayne L. Winston, "Business Analytics - Data Analysis and Decision Making", 5th Edition, Cengage, 2015.

Web Resources:

1. https://onlinecourses.nptel.ac.in/noc18-mg11/preview
2. https://nptel.ac.in/courses/110105089/

19ME O103

COMPOSITE MATERIALS

(Open Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Composite materials and their constituents.
2. Classification of the reinforcements and evaluate the behavior of composites.
3. Fabrication methods of metal matrix composites.
4. Manufacturing of Polymer matrix composites.
5. Failure mechanisms in composite materials.

Course Outcomes: Upon completion of this course, students will be able to:

1. Classify and characterize the composite materials.
2. Describe types of reinforcements and their properties.
3. Understand different fabrication methods of metal matrix composites.
4. Understand different fabrication methods of polymer matrix composites.
5. Decide the failure of composite materials.

UNIT–I

Introduction: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT–II

Reinforcements: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT–III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications.

Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepegs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT–V

Strength: Lamina Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength;

Text Books:

1. R.W.Cahn – VCH , "Material Science and Technology", (Vol 13) Composites, West Germany.
2. WD Callister, Jr., Adapted by R. Balasubramaniam , "Materials Science and Engineering, An introduction"., John Wiley & Sons, NY, Indian edition, 2007.

Suggested Reading:

1. Ed-Lubin, "Hand Book of Composite Materials"
2. K.K.Chawla, "Composite Materials".
3. Deborah D.L. Chung, "Composite Materials Science and Applications"
4. Daniel Gay, Suong V. Hoa, and Stephen W. Tsai, "Composite Materials Design and Applications"

19CE O101

COST MANAGEMENT OF ENGINEERING PROJECTS

(Open Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Enable the students to understand the concepts of Project management.
2. Provide knowledge on concepts of Project Planning and scheduling.
3. Create an awareness on Project Monitoring and Cost Analysis
4. Provide adequate knowledge to the students on Recourse Management Costing-Variance Analysis
5. Train the students with the concepts of Budgetary Control for cost management and to provide basic platform on Quantitative techniques for cost management.

Course Outcomes: Upon completing this course, students will be able to:

1. Acquire in-depth knowledge about the concepts of project management and understand the principles of project management.
2. Determine the critical path of a typical project using CPM and PERT techniques.
3. Prepare a work break down plan and perform linear scheduling using various methods.
4. Solve problems of resource scheduling and levelling using network diagrams.
5. Learn the concepts of budgetary control and apply quantitative techniques for optimizing project cost.

UNIT-I

Project Management: Introduction to project managements, stakeholders, roles, responsibilities and functional relationships. Principles of project management, objectives and project management system. Project team, organization, roles, responsibilities. Concepts of project planning, monitoring, staffing, scheduling and controlling.

UNIT-II

Project Planning and Scheduling: Introduction for project planning, defining activities and their interdependency, time and resource estimation. Work break

down structure. Linear scheduling methods-bar charts, Line of Balance (LOB), their limitations. Principles, definitions of network-based scheduling methods: CPM, PERT. Network representation, network analysis-forward and backward passes.

UNIT-III

Project Monitoring and Cost Analysis: introduction-Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making, Time cost tradeoff-Crashing project schedules, its impact on time on time, cost. Project direct and indirect costs.

UNIT-IV

Resources Management and Costing-Variance Analysis: Planning, Enterprise Resource Planning, Resource scheduling and levelling. Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis

Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement

UNIT-V

Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative Techniques for Cost Management: Linear Programming, PERT/ CPM, Transportation Assignment problems, Simulation, Learning Curve Theory.

Text Books:

1. Charles T Horngren "Cost Accounting A Managerial Emphasis", Pearson Education; 14th edition 2012,
2. Charles T. Horngren and George Foster, "Advanced Management Accounting" Prentice-Hall; 6th Revised edition, 1987
3. Robert S Kaplan Anthony A. Atkinson, "Management & Cost Accounting" , Pearson; 2nd edition, 1996
4. K. K Chitkara, "Construction Project Management: Planning, scheduling and controlling", Tata McGraw-Hill Education. 2004.
5. Kumar Neeraj Jha "Construction Project Management Theory and Practice", Pearson Education India; 2nd edition, 2015.

19ME O101

INDUSTRIAL SAFETY

(Open Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Causes for industrial accidents and preventive steps to be taken.
2. Fundamental concepts of Maintenance Engineering.
3. About wear and corrosion along with preventive steps to be taken
4. The basic concepts and importance of fault tracing.
5. The steps involved in carrying out periodic and preventive maintenance of various equipment used in industry

Course Outcomes: Upon completion of this course, students will be able to:

1. Identify the causes for industrial accidents and suggest preventive measures.
2. Identify the basic tools and requirements of different maintenance procedures.
3. Apply different techniques to reduce and prevent Wear and corrosion in Industry.
4. Identify different types of faults present in various equipment like machine tools, IC Engines, boilers etc.
5. Apply periodic and preventive maintenance techniques as required for industrial equipment like motors, pumps and air compressors and machine tools etc.

UNIT–I

Industrial Safety: Accident, causes, types, results and control, mechanical and electricalhazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc. Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT–II

Fundamentals of Maintenance Engineering: Definition and aim of maintenance engineering,Primary and secondary functions and responsibility of maintenance

department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT–III

Wear and Corrosion and their Prevention: Wear- types, causes, effects, wear reductionmethods, lubricants-types and applications, Lubrication methods, general sketch, working and applications of Screw down grease cup, Pressure grease gun, Splash lubrication, Gravity lubrication, Wick feed lubrication, Side feed lubrication, Ring lubrication, Definition of corrosion, principle and factors affecting the corrosion, Types of corrosion, corrosion prevention methods.

UNIT–IV

Fault Tracing: Fault tracing-concept and importance, decision tree concept, need andapplications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, any one machine tool, Pump, Air compressor, Internal combustion engine, Boiler, Electrical motors, Types of faults in machine tools and their general causes.

UNIT–V

Periodic and Preventive Maintenance: Periodic inspection-concept and need, degreasing,cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of Machine tools, Pumps, Air compressors, Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

Text Books:

1. H. P. Garg, "Maintenance Engineering", S. Chand and Company
2. Audels, "Pump-hydraulic Compressors", Mcgraw Hill Publication

Suggested Reading:

1. Higgins & Morrow, "Maintenance Engineering Handbook", Da Information Services.
2. Winterkorn, Hans, "Foundation Engineering Handbook", Chapman & Hall London.

19ME O102

INTRODUCTION TO OPTIMIZATION TECHNIQUES

(Open Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Come to know the formulation of LPP models
2. Understand the Transportation and Assignment techniques
3. Come to know the procedure of Project Management along with CPM and PERT techniques
4. Understand the concepts of queuing theory and inventory models
5. Understand sequencing techniques

Course Outcomes: Upon completing this course, students will be able to:

1. Formulate a linear programming problems (LPP)
2. Build and solve Transportation Models and Assignment Models.
3. Apply project management techniques like CPM and PERT to plan and execute project successfully
4. Apply queing and inventory concepts in industrial applications
5. Apply sequencing models in industries

UNIT - I

Operations Research: Definition, scope, Models, Linear programming problems (LPP), Formulation, Graphical Method, and Simplex Method

UNIT - II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT - III

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward

path, Determination of critical path, duration of the project, Free float, Independent float and Total float

UNIT - IV

Queuing Theory and Inventory: Kendols Notation, single server models, Inventory control - deterministic inventory models - Probabilistic inventory control models.

UNIT - V

Sequencing Models: Introduction, Objectives, General assumptions, processing 'n' jobs through two Machines, processing 'n' jobs through three machines.

Text Books:

1. H.A. Taha, "Operations Research, An Introduction", PHI, 2008.
2. H.M. Wagner, "Principles of Operations Research", PHI, Delhi, 1982.
3. J.C. Pant, "Introduction to Optimisation: Operations Research", Jain Brothers, Delhi, 2008.

Suggested Reading:

1. Hitler Libermann, "Operations Research", McGraw Hill Pub.2009.
2. Pannerselvam, "Operations Research", Prentice Hall of India, 2010.
3. Harvey M Wagner, "Principles of Operations Research", Prentice Hall of India, 2010.

19EE O101

WASTE TO ENERGY
(Open Elective)

Instruction	3 L Hours per Week
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course Objectives: This course aims to:

1. Know the various forms of waste
2. Understand the processes of Biomass Pyrolysis.
3. Learn the technique of Biomass Combustion.

Course Outcomes: Upon completing this course, students will be able to:

1. Understand the concept of conservation of waste
2. Identify the different forms of wastage
3. Choose the best way for conservation to produce energy from waste
4. Explore the ways and means of combustion of biomass
5. Develop a healthy environment for the mankind

UNIT-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT-II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized

bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy Program in India.

Text Books:

1. Desai, Ashok V, "Non Conventional Energy", Wiley Eastern Ltd., 1990.
2. Khandelwal, K. C. and Mahdi, S. S, "Biogas Technology - A Practical Hand Book", Vol. I &II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Suggested Reading:

1. Challal, D. S., "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1991.
2. C. Y. WereKo-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1996.