Dr. Babasaheb Ambedkar Technological University

(Established a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)

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Course structure and Detailed Syllabus

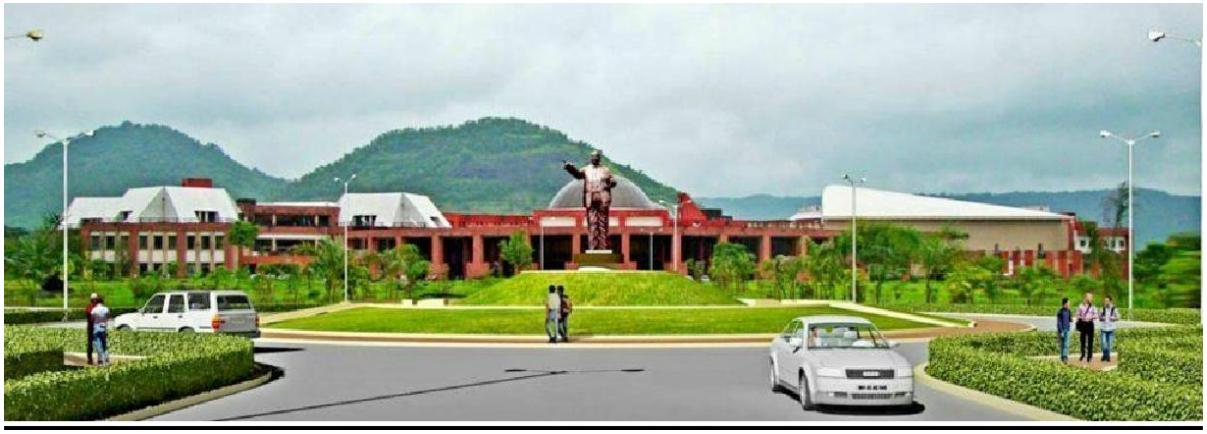
for

M. Tech Programme
in

Electronics and Communication (VLSI Design)

Two Year (Four Semesters) Course

In line with National Education Policy 2020 guidelines with effect from the academic year 2024-2025 for Affiliated Colleges Only



Dr. Babasaheb Ambedkar Technological University
M. Tech (VLSI, VLSI DESIGN)
In line with New Education Policy 2020 guidelines
(Effective from AY 2024-25 for Affiliated Colleges Only)

Semester I (Term 1)

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	MTECVLSI101	RTL Simulation & Synthesis with PLDs	3	1	0	20	20	60	100	4
2	PCC	MTECVLSI102	Advanced Digital Signal Processing	3	1	0	20	20	60	100	4
3	PEC	MTECVLSI103	Elective – I	3	1	0	20	20	60	100	4
4	PEC	MTECVLSI104	Elective – II	3	1	0	20	20	60	100	4
5	ELC	MTECVLSI105	Research Methodology	3	0	0	20	20	60	100	3
6	PCC	MTECVLSI106	PG Lab – I	0	0	2	25	--	25	50	1
7	PCC	MTECVLSI107	PG Lab – II	0	0	2	25	--	25	50	1
8	Audit Course	MTECVLSI108	Yoga And Stress Management	2	0	0	--	--	--	--	--
	Total for Semester I			**17**	**04**	**04**	**150**	**100**	**350**	**600**	**21**

Semester II (Term 2)

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PCC	MTECVLSI201	Analog & Digital VLSI Design	3	1	0	20	20	60	100	4
2	PCC	MTECVLSI202	VLSI Design Verification & Testing	3	1	0	20	20	60	100	4
3	PEC	MTECVLSI203	Elective – III	3	1	0	20	20	60	100	4
4	OE	MTVLSIOE204	Open Elective – I	3	0	0	20	20	60	100	3
5	ELC	MTECVLSI205	Intellectual Property Rights	3	0	0	20	20	60	100	3
6	PCC	MTECVLSI206	PG Lab – III	0	0	2	25	--	25	50	1
7	PCC	MTECVLSI207	PG Lab – IV	0	0	2	25	--	25	50	1
8	AEC/VEC/ IKS	MTVLSIAE208	IKS Bucket	2	0	0	25	--	25	50	2
9	Audit Course	MTECVLSI209	Disaster Management	2	0	0	--	--	--	--	--
	Total for Semester II			**19**	**03**	**04**	**170**	**120**	**410**	**700**	**22**

Semester III (Term 1)												
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	PEC	MTECVLSI301	Elective – IV	3	0	0	20	20	60	100	3
2	OE	MTECVLSI302	Open Elective – II	3	0	0	20	20	60	100	3
3	MDM	MTECVLSI303	Multidisciplinary minor	3	0	0	20	20	60	100	3
4	HSSM	MTECVLSI304	Project Management	3	0	0	20	20	60	100	3
5	ELC	MTECVLSI305	Project – I	--	--	--	50	--	50	100	10
	Total for Semester III			**12**	**0**	**0**	**130**	**80**	**290**	**500**	**22**

Semester IV (Term 2)											
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
				L	T	P	CA	MSE	ESE	Total	
1	ELC	MTECVLSI401	Project – II	--	--	--	100	--	100	200	20
	Total for Semester II			**--**	**--**	**--**	**100**	**--**	**100**	**200**	**20**

Abbreviations: PCC (Programme Core Course), PEC (Programme Elective Course), ELC (Experiential Learning Courses), OE (Open Elective), AEC (Ability Enhancement Courses), VEC (Value Education Courses), IKS (Indian Knowledge System), MDM (Multidisciplinary Minor).

Credit Distribution				
SEM I	**SEM II**	**SEM III**	**SEM IV**	**Total**
21	**22**	**22**	**20**	**85**

	Program Elective -I
A)	Image Processing & Computer Vision
B)	Programming Language for Embedded Systems
C)	Mixed Signal Design
D)	RF Engineering
E)	VLSI Signal Processing

	Program Elective -II
A)	Embedded System Design
B)	Parallel Processing
C)	System Design with Embedded Linux
D)	CAD of Digital Systems
E)	ASIC Design

	Program Elective -III

A)	Memory Technologies
B)	System On-Chip Design
C)	Low Power VLSI Design
D)	Computer networks
E)	Real Time Embedded Systems

	Program Elective -IV
A)	Network Security & Cryptography
B)	Physical Design Automation
C)	Reconfigurable Computing
D)	VLSI Sub-system Design
E)	Fault Tolerant Digital System Design

	Open Elective I
A)	Artificial Intelligence & Machine learning
B)	Operation Research
C)	Business Analytics
D)	Composite Materials
E)	Industrial Safety

	Open Elective II
A)	Student Psychology
B)	Business To Business Marketing (B2B)
C)	Organizational Behaviour
D)	Principles Of Economics
E)	Introduction to Public Administration

	Multidisciplinary Minor
A)	Digital Forensics
B)	E-commerce Technologies
C)	Modern Algebra
D)	Components And Applications of Internet of Things

	Indian Knowledge System (IKS)
A)	Indian Knowledge System (IKS): Concepts and Applications in Engineering
B)	Indian Knowledge System(IKS): Humanities and Social Sciences

First Year (Semester –I)
RTL Simulation & Synthesis with PLDs

MTECVLSI101	RTL Simulation & Synthesis with PLDs	PCC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Learn about Register-Transfer Level (RTL) design, including the use of registers and data paths in digital systems.
2. Familiarize yourself with different types of Programmable Logic Devices (PLDs), such as Field-Programmable Gate Arrays (FPGAs) and Complex Programmable Logic Devices (CPLDs).
3. Gain proficiency in Hardware Description Languages (HDLs) like VHDL or Verilog for RTL design and synthesis.
4. Understand testing and verification methodologies for digital circuits, including the use of test-benches and simulation test vectors.

Course Outcomes:

After the completion of course, the student will able to

1. Describe Finite State Machines and comprehend concepts of clock related issues.
2. Model digital circuits using Verilog and understand the concepts of analog and mixed signal Systems design using Verilog AMS.
3. Outline the concepts of different design flows in VLSI.
4. Illustrate different low power latches and Flip-flops.

UNIT-I

Design strategies

Top-down approach to design, Design of FSMs (Synchronous and asynchronous), Static timing analysis, Meta-stability, Clock issues, Need and design strategies for multi-clock domain designs.

UNIT-II

Modelling of digital circuits

Design entry by Verilog, Combinational and Sequential Logic Design: Multiplexer / Demultiplexer, ALU, parity circuits, Flip-flops, Shift Registers, Counters, Finite State Machines, Sequence generator, Sequence detector, Verilog AMS.

UNIT-III

Design methodologies

Programmable Logic Devices, FPGA, SoC, Introduction to ASIC Design Flow, Floor Planning, Placement, Clock tree synthesis, Routing, Physical verification.

UNIT-IV

Low power Latches and Flip-flops

Introduction, Need for low power latches and flip-flops, Evolution of Latches and Flip-flops, Quality measures for latches and flip-flops, Design perspective.

UNIT-V

IP and Prototyping

IP in various forms: RTL Source code, Encrypted Source code, SoftIP, Netlist, Physical IP, use of external hard IP during prototyping.

Textbooks/ References:

1. Richard S. Sandige, Modern Digital Design, McGraw-Hill Inc., US 1989
2. T. R. Padmanabhan, B. Bala Tripura Sundari, Design through Verilog HDL, Wiley-IEEE Press, 2004.
3. Bob Zeidman, Designing with FPGAs and CPLDs, CRC Press, 2002
4. Kiat-SengYeo, Samir S.Rofail, Wang-Ling Goh, CMOS/BICMOS ULSI: Low Voltage, Low Power, Pearson Education India, 2011.
5. Doug Amos, Austin Lesea, Rene Richter, FPGA Based Prototyping Methodology Manual, Xilinx.

First Year (Semester –I)
Advanced Digital Signal Processing

MTECVLSI102	Advanced Digital Signal Processing	PCC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Provide students with a deep understanding of advanced signal processing theories and mathematical concepts, including topics such as Fourier analysis, wavelet analysis, stochastic signal processing, and advanced linear algebra.
2. Develop expertise in digital signal processing techniques, algorithms, and tools. This includes knowledge of filter design, spectral analysis, adaptive signal processing, and multirate signal processing.

Course Outcomes:

After the completion of course, the student will able to

1. Proficiency in advanced mathematical techniques and tools used in signal processing, including complex analysis, Fourier analysis, wavelet analysis, and linear algebra.
2. The ability to represent and analyze signals in both time and frequency domains, including techniques such as Fourier transforms, Laplace transforms, and Z- transforms.
3. Proficiency in digital signal processing techniques, including the design and implementation of digital filters, discrete-time signal processing, and spectral analysis.
4. The ability to apply signal processing techniques to real-world problems in various domains, including telecommunications, audio and speech processing, image and video processing, and biomedical signal processing.

UNIT-I

Review of filter concept

Review of design techniques and structures for FIR and IIR filters, representation of numbers, quantization of filter coefficients, round-off effects in digital filters.

UNIT-II

Analysis of LSI systems

Frequency Analysis, Inverse Systems, Discrete Fourier Transform (DFT), Fast Fourier Transform algorithm, Implementation of Discrete Time Systems

UNIT-III

Multirate Digital Signal Processing

Introduction, Decimation by a factor D, Interpolation by a factor I, sampling rate conversion by rational factor I/D, implementation of sampling rate conversion, multistage implementation of sampling rate conversion, sampling rate conversion of band pass signals, sampling rate conversion by an arbitrary factor, application of Multirate signal processing, digital filter bank, two-channel quadrature-mirror filter bank, M-channel QMF bank.

UNIT-IV

Wavelet Transform

Introduction to wavelet transform- Short Time Fourier Transform (STFT), Waveletransform, Haar wavelet and Multirate resolution analysis, Daubechies wavelet, some other standard wavelets, applications of wavelet transform.

UNIT-V

Power Spectrum Estimation

Estimation of spectra from finite-duration observation of signals, non-parametric methods for power spectrum estimation, parametric methods for power spectrum estimation, filter bank methods, Eigen analysis algorithms for spectrum estimation.

Textbooks/ References:

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1999
2. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principle, Algorithms and Applications, Prentice Hall.
3. L. R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall.
4. J. R. Johnson, Introduction to Digital Signal Processing, Prentice Hall.
5. D. J. De Fatta, J. G. Lucas and W. S. Hodgkiss, Digital Signal Processing, J Wiley and Sons, Singapore

First Year (Semester –I)
Image Processing & Computer Vision

MTECVLSI103A	Image Processing & Computer Vision	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. To understand image fundamentals and how digital images can be processed
2. To understand image enhancement, image compression techniques and its application
3. Fundamentals of computer vision, geometrical features of images, object recognition
4. Explore application of real time image processing.

Course Outcomes:

After the completion of course, the student will able to

1. Recognize the fundamental techniques of Image Processing and Computer Vision.
2. Interpret the basics kills of designing image compression.
3. Distinguish between different image compression standards.
4. Analyze different computer vision techniques
5. Analyze real time image processing system.
6. Explore applications of computer vision

UNIT-I

Digital Image Fundamentals

A Simple Image Model, Sampling and Quantization, Relationship between Pixel, Image Formats and Image Transforms.

UNIT-II

Image Enhancement

Histogram processing, image subtraction, image averaging, smoothing filters, sharpening filters, enhancement in frequency and spatial domain, low pass filtering, high pass filtering.

UNIT-III

Image Compression

Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression, Recent Image Compression Standards.

UNIT-IV

Computer Vision: Imaging Geometry, Coordinate transformation and geometric warping for image registration, Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal Component Analysis, Shape priors for recognition, Implementation of computer vision algorithms using Raspberry Pi.

UNIT-V

Image Processing and Computer Vision Applications

Denoising of Image as pre- processing, Object recognition, Motion estimation, Object Tracking, Vision based control, vision for human computer interaction.

Text Books:

1. Gonzalez, R.C., and Woods, R.E., Digital Image Processing, Dorling Kingsley, 2009.
2. Jain A. K., Fundamentals of Digital Image Processing, Prentice Hall, 2007.
3. Sonka M., Image Processing and Machine Vision, Prentice Hall, 2007.
4. D. Forsyth and J. Ponce, Computer Vision - A modern approach, Prentice Hall.

Reference Books:

1. Tekalp A. M., Digital Video Processing, Prentice Hall, 1995.
2. Ghanbari M., Standard Codecs: Image Compression to Advanced Video Coding, IET Press, 2003.
3. E. Trucco and A. Verri, Introductory Techniques for 3D Computer Vision, Prentice Hall.

First Year (Semester –I)
Programming Language for Embedded Systems

MTECVLSI103B	**Programming Language for Embedded Systems**	**PEC**	**3L- 1T - 0P**	**4 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. To understand concept of C programming
2. Understand concept of OOPs
3. Explore different scripting languages

Course Outcomes:

After the completion of course, the student will able to

1. Write an embedded C application of moderate complexity.
2. Develop and analyze algorithms in C++.
3. Differentiate interpreted languages from compiled languages.
4. Analyze different operators in C++.
5. Explore concept of inheritance.

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, Embedded Software Development Cycle and Methods.

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 aclass, data members and methods, 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, virtual base class, Polymorphism, virtual functions.

UNIT-V

Templates

Function template and class template, member function templates and template arguments,

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

Text Books:

1. Michael J. Pont , “Embedded C”, Pearson Education, 2nd Edition, 2008
2. Randal L. Schwartz, “Learning Perl”, O‟Reilly Publications, 6th Edition 2011
3. Abraham Silberschatz, Peter B, Greg Gagne, “Operating System Concepts”, John Willey & Sons, 2005

Reference Books

1. A. Michael Berman, “Data structures via C++”, Oxford University Press, 2002
2. Robert Sedgewick, “Algorithms in C++”, Addison Wesley Publishing Company, 1999

First Year (Semester –I)

Mixed Signal Design

MTECVLSI103C	Mixed Signal Design	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Understand basics of comparator circuits
2. Implementation of A/D and D/A converters
3. Converter performance analysis with design challenges.

Course Outcomes:

After the completion of course, the student will able to

1. Apply knowledge of mathematics, science, and engineering to design CMOS analog Circuits to achieve performance specifications.
2. Identify, formulates, and solves engineering problems in the area of mixed-signal design
3. Analyze different data acquisition systems
4. Explore data converter architecture
5. Analyze various analog circuit designs

UNIT-I

Introduction

Device Models, IC Process for Mixed Signal, Concepts of MOS Theory. Comparators: Circuit Modeling, Auto Zeroing Comparators, Differential Comparators, Regenerative Comparators, Fully Differential Comparators, Latched Comparator.

UNIT-II

Data Converters

Requirements, Static and Dynamic Performance, SNR and BER, DNL, INL High Speed A/D Converter Architectures: Flash, Folding, Interpolating, pipelined High Speed D/A Converter Architectures: Nyquist-Rate D/A Converters, Thermometer Coded D/A Converters, Binary Weighted D/A Converter.

UNIT-III

Design of Data Acquisition System

Design of multi-channel low level and high level data acquisition systems using ADC/DAC, SHA and Analog multiplexers, designing of low power circuits for transducers. Programmable Capacitor Arrays (PCA), Switched Capacitor converters, Noise Spectrum, Sigma-Delta Modulation Method, Sigma- Delta A/D and D/A Converters, Non Idealities.

UNIT-IV

Key Analog Circuit Design

Analog VLSI building blocks, Operational Amplifiers for converters, advanced op-amp design techniques, Voltage Comparators, Sample-and-Hold Circuits. Implementation and Design of High Performance A/D and D/A Converters: System Design, Digital Compensation, Noise, and Mismatch, Layout and Simulation Technologies for Data Converters.

UNIT V

Design Challenges

Low Voltage Design, Ultra-High Speed Design, High Accuracy Design. Advanced Topics: Multipliers, Oscillators, Mixers, Passive Filter Design, Active filter design, Switched Capacitor Filters, Frequency Scaling, Phase-Locked Loops, and Device Modeling for AMS IC Design, Concept of AMS Modeling and Simulation.

Text Books:

1. Baker, R.J., Li, H. W. and Boyce, D. E., CMOS: Circuit Design, Layout and Simulation, IEEE Press (2007) 2nd ed
2. Gregorian, R. and Temes, G. C., Analog MOS Integrated Circuits for Signal Processing, Wiley (2002).

Reference Books:

1. Plassche, Rudy J. Van De, Integrated A-D and D-A Converters, Springer, (2007)
2. Jespers,P.G.A., Integrated Converters: D-A and A-D Architectures, Analysis and Simulation, Oxford University Press (2001).

First Year (Semester –I)
RF Engineering

MTECVLSI103D	RF Engineering	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. The objective of this course is to provide students with a comprehensive understanding of Radio Frequency (RF) engineering principles, techniques, and applications.
2. Students will learn about RF system design, transmission lines, antennas, microwave circuits, and the practical aspects of RF engineering to design, analyze, and optimize wireless communication systems.

Course Outcomes:

After the completion of course, the student will able to

1. Understand the fundamental concepts of RF engineering and its importance in wireless communication systems.
2. Design and analyze RF systems, including RF amplifiers, oscillators, and Frequency synthesizers.
3. Analyze and optimize the performance of transmission lines and RF networks.
4. Design and analyze RF antennas for various wireless applications.
5. Demonstrate proficiency in using RF simulation software tools.

UNIT-I

Introduction to RF Engineering

Overview of RF engineering and its applications in wireless communication. Frequency bands and spectrum allocation for various wireless systems. RF system parameters and performance metrics.

Transmission Lines and Waveguides

Characterization of transmission lines: impedance, reflection coefficient, and standing waves. Smith Chart and its applications in impedance matching. Types of waveguides and their properties.

UNIT-II

RF System Design

Design considerations for RF amplifiers, oscillators, and frequency synthesizers. Noise figure and noise temperature in RF systems. Phase-locked loops (PLL) and frequency synthesis techniques.

RF Network Analysis

S-parameters and their application in RF network analysis. Matching networks and impedance transformation. Scattering matrices and cascade analysis.

UNIT-III

Microwave Circuits and Components

Microwave passive components: couplers, splitters, and filters. Active microwave devices: PIN diodes, GaAsFETs, and HEMTs. Microwave integrated circuits (MIC) and monolithic microwave integrated circuits (MMIC).**RF Antennas**: Fundamental principles of antenna theory. Different types of RF antennas: wire antennas, patch antennas, and array antennas. Antenna radiation patterns and impedance matching.

UNIT-IV

RF Simulation Tools

Introduction to RF simulation software (e.g., ADS, CST, HFSS). Simulating and optimizing RF circuits and antennas using software tools. Practical lab sessions using simulation tools.

UNIT-V

RF Interference and Noise

Sources of RF interference and its impact on communication systems. Noise in RF systems: thermal noise, shot noise, and flicker noise. Noise figure and noise factor calculations.

Text Books

1. David M. Pozar, Microwave Engineering, Wiley
2. Behzad Razavi, RF Microelectronics, Prentice Hall

Reference Books

1. Richard C. Li, RF Circuit Design, Wiley.
2. Constantine A. Balanis, Antenna Theory: Analysis and Design, Wiley.

First Year (Semester –I)
VLSI Signal Processing

MTECVLSI103E	VLSI Signal Processing	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Introduce students to the fundamentals of VLSI signal processing and expose them to examples of applications.
2. Design and optimize VLSI architectures for basic DSP algorithms.
3. Design low power signal processing applications.

Course Outcomes:

After the completion of course, the student will able to

1. Able to modify the existing or new DSP architectures suitable for VLSI.
2. Understand the concepts of folding and unfolding algorithms and applications.
3. Implement fast convolution algorithms.
4. Able to design low power signal processing and wireless applications.
5. Implement digital filter for VLSI architectures

UNIT-I

Introduction to DSP

DSP algorithms, DSP algorithms benefits, Representation of DSP algorithms pipelining and parallel processing introduction, Pipelining of FIR digital filters, Parallel processing, Pipelining and parallel processing for Low Power Retiming introduction, Definitions and Properties, Solving System of inequalities, Retiming Techniques.

UNIT-II

Folding and Unfolding

Folding- introduction, folding transform, Register minimization Techniques, Register minimization in folded architectures, folding of multi rate systems Unfolding - introduction, An algorithm for unfolding, properties of unfolding, critical Path, unfolding and retiming, applications of unfolding.

UNIT-III

Systolic Architecture Design

Introduction, Systolic array design methodology, FIR systolic arrays, Selection of scheduling vector, Matrix multiplication and 2D Systolic array design, Systolic design for space representations contain delays.

UNIT-IV

Fast Convolution

Introduction, Cook-Toom algorithm, Winogard algorithm, Iterated convolution, Cyclic convolution, Design of fast convolution algorithm by inspection.

UNIT-V

Digital filter

Digital lattice filter structures, bit level arithmetic, architecture, redundant arithmetic. Numerical strength reduction, synchronous, wave and asynchronous pipe lines.

Text Books:

1. Keshab K. Parhi. VLSI Digital Signal Processing Systems, Wiley-Inter Sciences
2. Kung. S.Y., H.J. While house T.Kailath, VLSI and Modern signal processing, Prentice Hall

Reference Books:

1. Mohammed Ismail, Terri, Fiez, Analog VLSI Signal and Information Processing, McGraw Hill, 1994.
2. Jose E. France, Yannis Tsividls, Design of Analog Digital VLSI Circuits for Telecommunications and Signal Processing, Prentice Hall.

First Year (Semester –I)
Embedded System Design

MTECVLSI104A	Embedded System Design	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. To introduce students to the modern embedded systems and to show how to understand and program such systems using a concrete platform built around a modern embedded processor.

Course Outcomes

After the completion of course, the student will able to

1. Understand fundamental embedded systems design paradigms, architectures, possibilities, and challenges, both with respect to software and hardware.
2. Analyze various types memories used in embedded and smart device applications.
3. Analyze deep state-of-the-art theoretical knowledge in the areas of real-time systems.
4. Ability to analyze a system both as whole and in the included parts, to understand how these parts interact in the functionality and properties of the system

UNIT I

Fundamentals of Embedded System

Embedded System overview, Design challenges, Processor Technology, IC Technology, Design Technology.

UNIT II

Embedded System Hardware

Evaluation of Processors, Microprocessor architecture overview- CISC and RISC, Case study of Pentium processor architecture.

UNIT III

Study of semiconductor memory

Memory device characteristics, SRAM, DRAM, SSRAM, SDRAM, RDRAM, FLASH, Smart card memory and interfacing of memory with micro-controller.

UNIT IV

Introduction to DSP Processors

Architecture, features, instruction set, typical applications (TMS320XX or ADSP 21010).

UNIT V

Embedded software and Applications

Introduction to software Engineering, C cross compiler, Computational models, FSM, Concurrent state model, Concurrent Processes, Communication among processes, synchronization among processes. Introduction to RTOS: Windows CE, VX works.

Applications: Network protocols- TCP/IP, Embedded Ethernet, CANBUS, I2C bus, Mod Bus, Digital Camera.

Textbooks / References:

1. Frank Vahid and Tony Givargis, ―Embedded System Design A Unified Hardware/Software Introduction‖, Wiley; 1. Edition (24 Oct. 2001).
2. TI Application Report : The TMS320 Family of Digital Signal Processors
3. Tim Wilmshurst, an Introduction to the Design of Small-Scale Embedded Systems, Palgrave Publisher, 2004.

First Year (Semester –I)
Parallel Processing

MTECVLSI104B	Parallel Processing	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. To understand concept of parallel processing.
2. Different processors and its architecture
3. Explore parallel programming architecture

Course Outcomes:

After the completion of course, the student will able to

1. Identify limitations of different architectures of computer
2. Analysis quantitatively the performance parameters for different architectures
3. Investigate issues related to compilers and instruction set based on type of architectures.
4. Analyze multiprocessor architecture
5. Analyze various parallel programming techniques

UNIT-I

Introduction to Parallel Processing

Overview of Parallel Processing and Pipelining, Performance analysis, Scalability.

UNIT-II

Pipelining

Principles and implementation of Pipelining, Classification of pipelining processors, Advanced pipelining techniques, Software pipelining.

UNIT-III

VLIW processors and Architecture

Superscalar Architecture- Pentium, Intel Itanium Processor, Ultra SPARC, MIPS on FPGA, Vector and Array Processor, FFT Multiprocessor Architecture.

UNIT-IV

Multithreading

Multithreaded Architecture, Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions.

UNIT-V

Parallel Programming Techniques

Message passing program development, Synchronous and asynchronous message passing, Shared Memory Programming, Data Parallel Programming, Parallel Software Issues. Operating systems for multiprocessors systems customizing applications on parallel processing platforms.

Text Books:

1. Kai Hwang, Faye A. Briggs, “Computer Architecture and Parallel Processing”, MGH International Edition
2. Kai Hwang, “Advanced Computer Architecture”, TMH
3. V. Rajaraman, L. Sivaram Murthy, “Parallel Computers”, PHI.

Reference Books

1. William Stallings, “Computer Organization and Architecture, Designing for performance “Prentice Hall, Sixth edition
2. Kai Hwang, Zhiwei Xu, “Scalable Parallel Computing”, MGH

First Year (Semester –I)
System Design with Embedded Linux

MTECVLSI104C	**System Design with Embedded Linux**	**PEC**	**3L- 1T - 0P**	**4 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. To understand the embedded Linux development model
2. To be able to write and debug applications and drivers in embedded Linux.
3. To be able to understand and create Linux BSP for a hardware platform

Course Outcomes:

After the completion of course, the student will able to

1. Knowledge about embedded Linux development model.
2. Write drivers in embedded linux environment
3. Understand different hardware platform
4. Explore flavors of embedded linux
5. Understand IDE, root file system with respect to linux

UNIT-I

Introduction to Embedded Linux

Embedded Linux , Vendor Independence, Time to Market, Varied Hardware Support, Open Source, Standards (POSIX®) Compliance, Embedded Linux Versus Desktop Linux, Embedded Linux Distributions, BlueCat Linux, Cadenux, Denx, Embedded Debian (Emdebian), ELinOS (SYSGO), Metrowerks, Monta Vista Linux, RTLinuxPro, TimeSys Linux.

UNIT-II

Architecture of Embedded Linux

Embedded Linux Architecture, Real-Time Executive, Monolithic Kernels, Microkernel Architecture – HAL, Memory manager, Scheduler, File System, I/O and Networking subsystem, IPC, User space, Start-up sequence, Boot Loader Phase, Kernel Start-Up, User Space Initialization.

UNIT-III

Embedded Storages

Board Support Package Embedded Storage: MTD, Architecture, Drivers, Embedded File System Embedded Drivers: Serial, Ethernet, I2C, USB, Timer, Kernel Modules.

UNIT-IV

Porting Applications

Architectural Comparison, Application Porting Roadmap, Programming with Pthreads, Operating System Porting Layer (OSPL), Kernel API Driver, Real-Time Linux: Linux and Real time, Programming, Hard Real-time Linux.

UNIT-V

Building and Debugging

Kernel, Building the Kernel, Building Applications, Building the Root File System, Integrated Development Environment, Debugging Virtual Memory Problems, Kernel Debuggers, Root file system Embedded Graphics. Graphics System, Linux Desktop Graphics, Embedded Linux Graphics, Embedded Linux Graphics Driver, Windowing Environments.

Text Books:

1. Karim Yaghmour, "Building Embedded Linux Systems", O'Reilly & Associates
2. P Raghvan, Amol Lad, Sriram Neelakandan, "Embedded Linux System Design and Development", Auerbach Publications

Reference Books:

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

First Year (Semester –I)
CAD of Digital Systems

MTECVLSI104D	CAD of Digital Systems	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. To understand the fundamentals of CAD tools for modeling, design, test and verification of VLSI Systems
2. To study various phases of CAD, including simulation, physical design, test and Verification.
3. To be able to demonstrate the knowledge of computational algorithms and tools for CAD

Course Outcomes:

After the completion of course, the student will able to

1. Fundamentals of CAD tools for modelling, design, test and verification of VLSI systems.
2. Understand various phases of CAD, including simulation, physical design, test and verification.
3. Explore various optimization algorithms
4. Analyze various simulation models
5. Implement simple circuit using VHDL tools

UNIT-I

Introduction to VLSI Methodologies

Design and Fabrication of VLSI Devices, Fabrication Materials, Transistor Fundamentals, Fabrication of VLSI Circuits, Design Rules Layout of Basic Devices, Fabrication Process and its Impact on Physical Design, Scaling Methods, Status of Fabrication Process, and Issues related to the Fabrication Process, Future of Fabrication Process, and Solutions for Interconnect Issues, and Tools for Process Development.

UNIT-II

VLSI design automation tools

Data Structures and Basic Algorithms, Basic Terminology, Complexity Issues and NP-hardness, Basic Algorithms, Basic Data Structures, graph theory and Computational complexity, tractable and intractable problems.

UNIT-III

General purpose methods for combinational optimization

Partitioning- Problem Formulation, Classification of Partitioning Algorithms, Group Migration Algorithms , Simulated Annealing Simulated Evolution, Other Partitioning Algorithms Performance Driven Partitioning Floor planning- Chip planning , Pin Assignment , Integrated Approach, Placement- Problem Formulation , Classification of Placement Algorithms, Simulation Based Placement Algorithms , Partitioning Based Placement Algorithms , Performance Driven Placement, Routing -Global Routing, , Problem Formulation , Classification of Global Routing Algorithms,

Maze Routing Algorithms, Line-Probe Algorithms, Shortest Path Based Algorithms. Steiner Tree based Algorithms Integer Programming Based Approach, Performance Driven Routing.

UNIT-IV
Simulation
Gate-level Modeling and Simulation, Switch-level Modeling and Simulation, Logic Synthesis and Verification - Introduction to Combinational Logic Synthesis, Binary-decision Diagrams, Two-level Logic Synthesis, and High-level Synthesis- Hardware Models for High level Synthesis, Internal Representation of the Input Algorithm, Allocation, Assignment and Scheduling.

UNIT-V
MCMs-VHDL implementation of simple circuits. CAD tools and their use; Design for testability.

Text Books:
1. N.A. Sherwani, "Algorithms for VLSI Physical Design Automation".
2. S.H. Gerez, "Algorithms for VLSI Design Automation.

Reference Books:
1. M. Sarrafzadeh and C.K. Wong, An Introduction to VLSI Physical Design, McGraw Hill, 1996
2. D.D Gajski et al., High Level Synthesis: Introduction to Chip and System Design, Kluwer Academic Publishers, 1992

First Year (Semester –I)
ASIC Design

MTECVLSI104E	ASIC Design	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. To be an entry-level industrial standard ASIC or FPGA designer.
2. Understanding of issues and tools related to ASIC/FPGA design and implementation.
3. Understanding of basics of System on Chip and Platform based design

Course Outcomes:

After the completion of course, the student will able to

1. Demonstrate VLSI tool-flow and appreciate FPGA and CPLD architectures
2. Understand the issues involved in ASIC design, including technology choice, design management and tool-flow.
3. Understand about STA, LEC, DRC, LVS, DFM
4. Understand Semicustom Design Flow and Tool used – from RTL to GDS and Logical to Physical Implementation
5. Understand the basics of System on Chip and on chip communication architectures appreciate high performance algorithms for ASICs

UNIT-I

Introduction to Technology, Types of ASICs, and VLSI Design flow, Design and Layout Rules, Programmable ASICs, Antifuse, SRAM, EPROM, EEPROM based ASICs. Programmable ASIC logic cells and I/O cells. Programmable interconnects. Advanced FPGAs and CPLDs and Soft-core processors.

UNIT-II

ASIC physical design issues, System Partitioning, Floor planning and Placement. Algorithms: K-L, FM, Simulated annealing algorithms. Full Custom Design: Basics, Needs & Applications. Schematic and layout basics, Full Custom Design Flow.

UNIT-III

Semicustom Approach: Synthesis (RTL to GATE netlist) - Introduction to Constraints (SDC), Introduction to Static Timing Analysis (STA). Place and Route (Logical to Physical Implementation): Floor plan and Power-Plan, Placement, Clock Tree Synthesis (clock planning), Routing, Timing Optimization, GDS generation.

UNIT-IV

Extraction, Logical equivalence and STA: Parasitic Extraction Flow, STA: Timing Flow, LEC: Introduction, flow and Tools used. Physical Verification: Introduction, DRC, LVS and basics of DFM.

UNIT-V

System-On-Chip Design - SoC Design Flow, Platform-based and IP based SoC Designs, Basic

Concepts of Bus-Based Communication Architectures.

Text Books:

1. Sudeep Pasricha and Nikil Dutt, On-Chip Communication Architectures System on Chip Interconnect, Elsevier, 2008
2. M.J.S. Smith : Application Specific Integrated Circuits, Pearson, 2003
3. N. Jha & S.D. Gupta, “Testing of Digital Systems”, Cambridge, 2003

Reference Books:

1. Jan. M. Rabaey et al, Digital Integrated Circuit Design Perspective (2/e), PHI 2003
2. David A. Hodges, Analysis and Design of Digital Integrated Circuits (3/e), MGH 2000

First Year (Semester –I)
Research Methodology

MTECVLSI105	Research Methodology	ELC	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course objectives:

1. To give an overview of the research methodology and explain the technique of defining a research problem
2. To explain the functions of the literature review in research.
3. To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.
4. To explain various research designs and their characteristics.
5. To explain the details of sampling designs, and also different methods of data collections.
6. To explain the art of interpretation and the art of writing research reports

Course outcomes:

After the completion of course, the student will able to

1. Discuss research methodology and the technique of defining a research problem
2. Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
3. Explain various research designs and their characteristics.
4. Explain the art of interpretation and the art of writing research reports

UNIT-I

Introduction to Research and Problem Definition

Meaning, Objective and importance of research, Types of research, steps involved in research, defining research problem

UNIT-II

Research Design

Research design, Methods of research design, research process and steps involved, Literature Survey

UNIT-III

Data Collection

Classification of Data, Methods of Data Collection, Sampling, Sampling techniques procedure and methods, Ethical considerations in research

UNIT-V

Data Analysis and interpretation

Data analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis, Hypothesis testing, Data processing software (e.g. SPSS etc.), statistical inference, Interpretation of results

UNIT-V

Technical Writing and reporting of research

Types of research report: Dissertation and Thesis, research paper, review article, short communication, conference presentation etc., Referencing and referencing styles, Research Journals, Indexing and citation of Journals, Intellectual property, Plagiarism

Text Books:

1. C. R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques , New Age International publishers, Third Edition.
2. Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005.
3. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
4. Creswell, John W. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2013.

First Year (Semester –I)
PG Lab – I

MTECVLSI106	**PG Lab – I**	**PCC**	**0L- 0T - 2P**	**1 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 0hrs./week Tutorial: 0 hr./week Practical: 2hrs./week	Continuous Assessment: 25 Marks End Semester Exam: 25 Marks

Practical's of the PG Lab - I shall be based on the courses of first semester. The lab work shall consists of hands on experiments on the different software and hardware platforms related to the syllabus.

First Year (Semester –I)
PG Lab – II

MTECVLSI107	**PG Lab – II**	**PCC**	**0L- 0T - 2P**	**1 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 0hrs./week Tutorial: 0 hr./week Practical: 2hrs./week	Continuous Assessment: 25 Marks End Semester Exam: 25 Marks

Practical's of the Lab - I shall be based on the courses of first semester. The lab work shall consists of hands on experiments on the different software and hardware platforms related to the syllabus.

First Year (Semester –I)
Yoga and Stress Management

MTECVLSI108	Yoga And Stress Management	Audit Course	2L- 0T - 0P	0 Credits

Teaching Scheme	Examination Scheme
Lecture: 2hrs./week Tutorial: 0 hr./week	Continuous Assessment: -- End Semester Exam: --

Course Objectives:

1. Understand the physiological and psychological aspects of stress and its impact on overall well-being.
2. Learn and practice specific yoga postures, breathing exercises, and relaxation techniques to alleviate stress.
3. Explore the connection between mindfulness, meditation, and stress reduction, fostering mental clarity.
4. Discover holistic practices that promote better sleep, nutrition, and overall lifestyle habits for stress management.
5. Develop practical skills to manage stress in daily life, enhancing resilience and promoting emotional balance.

Course Outcomes:

After the completion of course, the student will able to

1. Recognize the signs and sources of stress, understanding its effects on mental and physical well-being.
2. Master a variety of yoga techniques, including postures, breathing, and meditation, to effectively manage stress.
3. Acquire relaxation strategies that promote calmness, reduce anxiety, and enhance overall mental clarity.
4. Incorporate healthy habits inspired by yoga principles to foster better sleep, nutrition, and self-care routines.
5. Develop practical skills to navigate and cope with stress, enhancing emotional balance and promoting a more harmonious life.

UNIT I

Introduction to Yoga for Stress Management - 1
Introduction to Yoga for Stress Management - 2
Stress according to Western perspective
Stress Eastern Perspective
Developmental process: Western and Eastern Perspective, Stress Hazards and Yoga

UNIT II

Meeting the challenges of Stress - 1
Meeting the challenges of Stress - 2
Introduction to Stress Physiology
Stress, Appetite and Dietary management- Modern and Yogic perspective
Sleep and Stress: understanding the relationship for effective management of stress

UNIT III

Stress Assessment methods- a valuable tool toward stress management
Role of Yoga in prevention and management of stress related disorders – a summary of research evidence
Concept of stress and its management - perspectives from Patanjali Yoga Sutra - Part 1
Concept of stress and its management - perspectives from Patanjali Yoga Sutra - Part 2
Concept of stress and its management - perspectives from Patanjali Yoga Sutra - Part 3

UNIT IV

Concept of stress and its management - perspectives from Bhagavad Gita - Part 1
Concept of stress and its management - perspectives from Bhagavad Gita - Part 2
Concept of stress and its management - perspectives from Bhagavad Gita - Part 3

UNIT V

Bio-Psycho-Socio-Spiritual model of stress management Yoga practices for Stress Management
Breathing practices – 1: Hands in and out breathing, Hands stretch breathing, Ankle stretch breathing
Breathing practices – 2: Dog Breathing, Rabbit breathing, Tiger breathing, Sashankasana breathing
Breathing practices – 3: Bhujangasana breathing, Ardha Shalabhasana breathing (alternate legs), Straight leg raising (alternate legs), Straight leg raising (both legs), Sethubandhasana lumbar stretch, Instant Relaxation Technique (IRT)
Loosening Practices – 1: Shoulder Rotation, Side bending, standing twist, Hip rotation, Thigh strengthening
Loosening practices – 2: Chakki chalan, Bhunamasana Chalana, Alternative toe touching
Loosening practices – 3: Side leg raising, Pavana muktasana kriya: Wind releasing pose movements, Quick Relaxation Technique (QRT)

Hands-on Practice on following asanas and pranayamas:

Asana practices – 1: Tadasana, Ardhakati Chakrasana, Ardha Chakrasana, Trikonasana, Vrikshasana Asana practices – 2: Vakarasana, Janu Sirshasana, Ushtrasana, Sashankasana,
Asana practices – 3: Ardhamatseyndrasana, Paschimottanasana, Poorvottanasana, Gomukhasana
Asana practices – 4: Makarasana, Bhujangasana, Salambha Shalabahasana, Dhanurasana
Asana practices – 5: Setubandhasana, Sarvangasana, Mastyasana, Deep Relaxation Technique (DRT) Soorya Namaskar
Pranayama – 1: Kapalbhati kriya and Sectional Breathing
Pranayama – 2: Nadishuddhi Pranayama
Pranayama – 3: Bhramari, Sheetali, Sitkari and Ujjayi
Om Meditation, Cyclic Meditation

Textbooks / References:

1. H R Nagendra and R Nagarathna. Yoga for Promotion of Positive Health. Swami Vivekananda Yoga Prakashana. 2011.
2. Contrada, R., & Baum, A. (Eds.). The handbook of stress science: Biology, psychology, and health. Springer Publishing Company. 2010
3. Al'Absi, M. (Ed.). Stress and addiction: Biological and psychological mechanisms. Elsevier. 2011.
4. Van den Bergh, O. Principles, and practice of stress management. Guilford Publications. 2021.
5. Swami Muktibodhananda, Hatha Yoga Pradipika, Bihar Scool of Yoga, 1998
6. Swami Satyananda Saraswati, Four Chapters on Freedom, Bihar Scool of Yoga, 1975
7. Swami Tapasyananda, Srimad Bhagavat Gita, Sri Ramakrishna Math, 2012

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Yoga for Stress Management	Dr H R Nagendra, Dr Mithila M V, Dr Rajesh Nair	Swami Vivekananda Yoga Anusandhana Samsthana	https://onlinecourses.swayam2.ac.in/aic23_ge10/preview#:~:text=In%20this%20course%20we%20intend,meeting%20the%20challenges%20of%20stress

First Year (Semester – II)
Analog & Digital VLSI Design

MTECVLSI201	**Analog & Digital VLSI Design**	**PCC**	**3L- 1T - 0P**	**4 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Objectives:

1. To teach fundamentals of CMOS Digital integrated circuit design such as importance of Combinational MOS logic circuits, and Sequential MOS logic circuits.
2. To teach the fundamentals of Dynamic logic circuits and basic semiconductor memories which are the basics for the design of high performance digital integrated circuits.
3. Basic design concepts, issues and tradeoffs involved in analog IC design are explored
4. To learn about Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op-Amps, Power Supply Rejection Ratio of Two-Stage Op Amps, and Cascade Op Amps, Measurement Techniques of OP Amp.

Course Outcomes:

After the completion of course, the student will able to

1. Gain the knowledge about Technology scaling & NMOS Fabrication process.
2. Appreciate the trade-offs involved in analog integrated circuit design.
3. Understand and appreciate the importance of noise and distortion in analog circuits.
4. Analyze complex engineering problems critically in the domain of analog IC design for conducting research.
5. Demonstrate advanced knowledge in Static and dynamic characteristics of CMOS, Alternative CMOS Logics, Estimation of Delay and Power, Adders Design.
6. Solve engineering problems for feasible and optimal solutions in the core area of digital ICs.

Analog CMOS Design

UNIT-I:

Single Stage Amplifier: CS stage with resistance load, Divide connected load, Current source load, Triode load, CS stage with source degeneration, Source follower, Common gate stage, Cascade stage, Choice of device models. Differential Amplifiers: Basic difference pair, Common mode response, Differential pair with MOS loads, Gilbert cell.

UNIT-II

Passive and active current mirrors: Basic current mirrors, Cascade mirrors, Active current mirrors. Frequency response of CS stage: Source follower, Common gate stage, Cascade stage and difference pair, Noise.

UNIT-III

Operational amplifiers: One stage OPAMP, Two stage OPAMP, Gain boosting, common mode feedback, Slew rate, PSRR, Compensation of 2 stage OPAMP, Other compensation techniques.

Digital CMOS Design:

UNIT-IV:

Technology Scaling and Road map, Scaling issues, Standard 4 mask NMOS Fabrication process. Review: Basic MOS structure and its static behavior, Quality metrics of a digital design: Cost, Functionality, Robustness, Power, and Delay, Stick diagram and Layout, Wire delay models. Inverter: Static CMOS inverter, Switching threshold and noise margin concepts and their Evaluation, Dynamic behavior, Power consumption. **(8hrs)**

UNIT-V:

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, Logical effort, Pass transistor logic, Dynamic logic, Speed and power dissipation in dynamic logic, cascading dynamic gates, CMOS transmission gate logic. **(6hrs)**

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.
2. Baker, Li, Boyce, "CMOS Circuit Design, Layout, and Simulation", Wiley, 2nd Edition.
3. Behzad Razavi , "Design of Analog CMOS Integrated Circuits", TMH, 2007.

References:

1. Phillip E. Allen and Douglas R. Holberg, "CMOS Analog Circuit Design", Oxford, 3rd Edition.
2. R J Baker, "CMOS circuit Design, Layout and Simulation", IEEE Inc., 2008.
3. Kang, S. and Leblebici, Y., "CMOS Digital Integrated Circuits, Analysis and Design", TMH, 3rd Edition.
4. Pucknell, D.A. and Eshraghian, K., "Basic VLSI Design", PHI, 3rd Edition.

First Year (Semester –II)
VLSI Design Verification & Testing

MTECVLSI202	VLSI Design Verification & Testing	PCC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Objectives:

1. In this course students will learn test economics, fault modelling, and logic and fault simulation, ATPG concepts for combinational and sequential circuits.
2. Students will also able to write testbench for the complex VLSI design using System Verilog.

Course Outcomes:

After the completion of course, the student will able to

1. Acquire knowledge about fault modelling and collapsing.
2. Learn about various combinational automatic test pattern generation techniques.
3. Learn about various sequential automatic test pattern generation techniques.
4. Analyze different memory faults and its testing methods.
5. Develop the verification plan for the small to complex VLSI designs.
6. Develop testbench using HVL for testing and verification of VLSI designs.

UNIT-I

Role of testing in VLSI design, issues in test and verification of complex chips, VLSI test process and equipment, Test economics, Yield analysis and product quality.
Verification guidelines: Verification Process, Basic Testbench functionality, directed testing, Methodology basics, Constrained-Random stimulus, Functional coverage, Testbench components, Layered testbench, Building layered testbench, Simulation environment phases, Maximum code reuse, Testbench 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.

UNIT-III

ATPG for combinational circuits: D-Algorithm, Boolean Difference, PODEM, Random, Exhaustive and Weighted Test Pattern Generation, Aliasing and its effect on Fault coverage. ATPG for sequential circuits: ATPG for Single-Clock Synchronous Circuits, Time frame expansion method, Simulation-Based Sequential Circuit ATPG.

UNIT-IV

Memory testing and BIST: Permanent, Intermittent and pattern sensitive faults, March test notion, Memory testing using march tests, PLA testing, Ad-Hoc DFT methods, Scan design, Partial scan design, Random logic for BIST, Memory BIST.

UNIT-V

Verification: Design verification techniques based on simulation, Analytical and formal approaches, Functional verification, Timing verification, Formal verification, Basics of equivalence checking and model checking, Hardware emulation. Hardware verification language: Introduction to System Verilog, Development of stimulus generator, Monitor and complete test bench using System Verilog.

Text Books:

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

References:

1. M. Abramovici, M. Breuer, and A. Friedman, Digital System Testing and Testable Design, IEEE Press, 1994
2. Diraj K. Pradhan, "Fault Tolerant Computer System Design", Prentice Hall.
3. L. T. Wang, C. W. Wu, and X. Wen, VLSI Test Principles and Architectures, Morgan Kaufmann, 2006.
4. System-on-a-Chip Verification-Methodology and Techniques, P. Rashinkar, Paterson and L. Singh, Kluwer Academic Publishers, 2001
5. Janick Bergeron, "Writing test benches functional verification of HDL models" Kluwer Academic Publishers, 2002.

First Year (Semester –II)
Memory Technologies

MTECVLSI203A	Memory Technologies	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. To know the RAM technologies, architecture and applications
2. To know the circuit design concepts of Non-volatile memories
3. To understand the Memory package density technologies

Course Outcomes:

After the completion of course, the student will able to

1. Select architecture and design semiconductor memory circuits and subsystems
2. Identify various fault models, modes and mechanisms in semiconductor memories and their testing procedures.
3. Know, how of the state-of-the-art memory chip design
4. Explore nonvolatile memories
5. Analyze high performance memories and its power dissipation
6. Analyze issues of low voltage memory design

UNIT-I

Introduction to Memory Chip Design

Basics of Semiconductor Memory, Internal Organization of Memory Chips, Memory Cell Array, Peripheral Circuit, I/O Interface Categories of Memory Chip, History of Memory-Cell Development, Architectures of memory cell: SRAM Cell, DRAM Cell Trends in Non-Volatile Memory Design and Technology, Ferroelectric memory, Basic Operation of Flash Memory Cells, Advances in Flash-Memory Design and Technology.

UNIT-II

Basics of RAM Design and Technology

Devices, NMOS Static Circuits, NMOS Dynamic Circuits, CMOS Circuits, Basic Memory Circuits, Scaling Law.

DRAM Circuits

High-Density Technology, High-Performance Circuits, Catalog Specifications of the Standard DRAM, Basic Configuration and Operation of the DRAM Chip, Chip Configuration, Address Multiplexing, Fundamental Chip, Multi-divided Data Line and Word Line, Read and Relevant Circuits, Write and Relevant Circuits, Refresh-Relevant Circuits, Redundancy Techniques, On-Chip Testing Circuits, High Signal-to-Noise Ratio DRAM Design and Technology, Trends in High S/N Ratio Design, Data-Line Noise Reduction, Noise Sources.

UNIT-III

Non-Volatile Memories

Masked ROMs, PROMs, Bipolar & CMOS PROM, EEPROMs, Floating Gate EPROM Cell, OTP EPROM, EEPROMs, Non-volatile SRAM, Flash Memories.

UNIT-IV

High-Performance Subsystem Memories

Hierarchical Memory Systems, Memory- Subsystem Technologies, High-Performance Standard DRAMs, Embedded Memories. Low-Power Memory Circuits: Sources and Reduction of Power Dissipation in a RAM Subsystem and Chip, Low-Power DRAM Circuits, Low-Power SRAM Circuits.

UNIT-V

Ultra-Low-Voltage Memory Circuits

Design Issues for Ultra-Low-Voltage RAM Circuits, Reduction of the Sub threshold Current, Stable Memory-Cell Operation, Suppression of, or Compensation for, Design Parameter Variations, Power-Supply Standardization, Ultra-Low Voltage DRAM Circuits, Ultra-Low-Voltage SRAM Circuits, and Ultra-Low-Voltage SOI Circuits.

Text Books:

1. Ashok K Sharma, “Advanced Semiconductor Memories: Architectures, Designs and Applications”, Wiley Interscience
2. Kiyoo Itoh, “VLSI memory chip design”, Springer International Ed.

Reference Books:

1. Ashok K Sharma,” Semiconductor Memories: Technology, Testing and Reliability, PHI
2. Adams, R. D., High performance Memory Testing: Design Principles, Fault Modeling and Self- Test, Springer (2002)
3. Prince, B., Semiconductor Memories: A handbook of Design, Manufacture and Application, John Wiley (1996) 2nd ed.

First Year (Semester –II)
System On-Chip Design

MTECVLSI203B	System On-Chip Design	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Learn SOC design processes
2. To understand ASIC design flow
3. Understand test optimization with system integration issues

Course Outcomes:

After the completion of course, the student will able to

1. Acquire knowledge about Top-down SoC design flow.
2. Understand the ASIC Design flow and EDA tools
3. Identify and formulate a given problem in the framework of SoC based design approach
4. Design SoC based system for engineering applications
5. Realize impact of SoC on electronic design philosophy and Macro-electronics

UNIT-I

ASIC

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.

UNIT-II

NISC

NISC Control Words methodology, NISC Applications and Advantages, Architecture Description Languages (ADL) for design and verification of Application Specific Instruction set Processors (ASIP), No-Instruction-Set-computer (NISC)- design flow, modeling NISC architectures and systems, use of Generic Netlist Representation - A formal language for specification, compilation and synthesis of embedded processors.

UNIT-III

Simulation

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

UNIT-IV

Low power SoC design

Design synergy, 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, building block memory, power down techniques, power consumption verification.

UNIT-V

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 Single core and Multi core systems, dark silicon issues, HDL coding techniques for minimization of power consumption, Fault tolerant designs. **(7hrs)**

Text Books:

1. Wolf, W., Modern VLSI Design: System-on-chip Design, Prentice Hall (2002) 3rd ed.
2. B. Al Hashimi, "System on chip-Next generation electronics", The IET, 2006
3. Hubert Kaeslin, "Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication", Cambridge University Press, 2008

Reference Books:

1. Rochit Rajsuman, "System-on- a-chip: Design and test", Advantest America R & D Center,2000
2. Michael J. Flynn and Wayne Luk, "Computer System Design: System-on-Chip". Wiley

First Year (Semester –II)
Real Time Embedded Systems

MTECVLSI203E	Real Time Embedded Systems	PEC	3L- 1T - 0P	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 1 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Introduction to embedded system architecture & its software.
2. Enabling students to design an embedded system using various methodologies.
3. Preparing students to build process for an embedded system.

Course Outcomes:

After the completion of course, the student will able to

1. Comprehend Embedded Processor and its software
2. Design an Embedded system with different modeling techniques
3. Design an Embedded system using processors, memory I/O devices and communication networks.
4. Incorporate operating system in an embedded system.
5. Comprehend the operation of multitasking in an Embedded System and implementation

UNIT-I

Embedded System hardware

Embedded systems overview, Hardware components like microcontroller, GPP, ASSP, AISP, SOC, Details of 32 bit ARM7 core based SoC architecture, Organization, analog, digital & high speed I/O for embedded systems, interfacing SRAM, DRAM, flash memories with microcontroller, memory management.

UNIT-II

Embedded System Software

Techniques of writing efficient C code for microcontroller C data types for ARM, Signed & unsigned data types, limitation of char & char & data types, storage class – static & extern, volatile keyword, operation on bits, functions, ARM / Thumb procedural call standard, pointers & arrays, conditional statements – if else, switch, structure, conditional loops – for & while, preprocessing, compiling, cross compiling, compiler driver, startup code and board support packages, calling assembly routines in C, interrupt handling in C, interrupt latency. **(7hrs)**

UNIT-III

ARM Philips NXP LPC2148 Microcontroller

Programming & Interfacing: Programming on – chip components like ADC, UART, Timers, External Interrupts and interfacing external peripherals like keyboard, LCD, Stepper motor.

UNIT-IV

Uniprocessor Real Time Operating Systems – I

Real time systems, goals and services, tasks and its states, task assignment & scheduling, Task

Control Blocks, Context & Context Switching, ISRs, Security Issues, inter- task communication, semaphore.

UNIT-V

Uniprocessor Real Time Operating Systems – II

Task Scheduling models, scheduling algorithms – rate monotonic and earliest deadline first, priority inheritance protocol, priority ceiling protocol, real time operating system features, features of micro COS – II RTOS.

Text Books:

1. Rajkamal, Embedded Systems, Tata Mc-Graw Hill.
2. Iyer & Gupta, Embedded Real-time System Programming, Tata Mc-Graw Hill.

Reference Books:

1. Furber, ARM System on Chip Architecture, Pearson India.
2. Adams, R. D., High performance Memory Testing: Design Principles, Fault Modeling and Self-Test, Springer (2002)
3. K. V. Shibu, Introduction to Embedded System, Mc-Graw Hill.
4. Philips NXP LPC 2148 user manual
5. Cottet, Delacroix & Mammeri, Scheduling in Real Time Systems, John Wiley & Son.
6. Rajib Mall, Real Time Systems, Pearson, India.

First Year (Semester –II)
Artificial Intelligence & Machine learning

MTECVLSI204A	**Artificial Intelligence & Machine learning**	**OE**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. The objective of this course is to provide students with a comprehensive understanding of artificial intelligence (AI) and machine learning (ML) concepts, techniques, and applications.
2. The course aims to equip students with the knowledge and skills required to design, implement, and apply AI and ML algorithms in communication technologies and other domains.

Course Outcomes:

After the completion of course, the student will able to

1. Understand the fundamental principles of artificial intelligence and machine learning.
2. Analyze and evaluate different AI and ML algorithms and models.
3. Design and implement AI and ML solutions for real-world problems.
4. Apply AI and ML techniques to optimize and enhance communication systems.
5. Utilize their skills to develop AI-driven applications in various domains.

UNIT-I

Introduction to Artificial Intelligence

Basics of artificial intelligence: definition, history, and applications. Comparison between AI and traditional computing approaches. Ethical considerations in AI. Machine Learning Fundamentals Introduction to machine learning concepts. Types of machine learning: supervised, unsupervised, reinforcement learning. Machine learning process: data preprocessing, training, evaluation, and deployment.

UNIT-II

Supervised Learning Algorithms

Linear regression. Logistic regression. K-Nearest Neighbors (k-NN). Support Vector Machines (SVM). Unsupervised Learning Algorithms. K-Means clustering. Hierarchical clustering. Principal Component Analysis (PCA).

UNIT-III

Neural Networks and Deep Learning

Basics of artificial neural networks (ANN). Convolutional Neural Networks (CNN). Recurrent Neural Networks (RNN). Introduction to deep learning frameworks. Reinforcement Learning Introduction to reinforcement learning. Markov decision processes and Q-learning. Applications of reinforcement learning in communication technologies.

UNIT-IV

Natural Language Processing (NLP)

Basics of NLP: tokenization, part-of-speech tagging, sentiment analysis. Introduction to word embedding. Text generation and language models. **(7hrs)**

UNIT-V

Emerging Trends in AI and Machine Learning

AI in edge computing and IoT. Explainable AI and interpretability.
AI ethics and bias considerations.

Text Books

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer.
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning, MIT Press.

Reference Books

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson
2. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, O'Reilly Media (or latest edition).

First Year (Semester –II)
Operation Research

MTECVLSI204B	Operation Research	OE	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. The objective of this course is to provide students with a comprehensive understanding of operations research principles, methodologies, and techniques.
2. The course aims to equip students with the knowledge and skills required to analyze complex engineering problems, make informed decisions, and optimize processes in communication technologies and related domains.

Course Outcomes:

After the completion of course, the student will able to

1. Understand the fundamental principles of operations research.
2. Apply mathematical models and techniques to solve engineering optimization problems.
3. Analyze and evaluate different operations research methodologies.
4. Design and implement optimization solutions for real-world problems.
5. Utilize their skills to improve decision-making and resource allocation in communication systems.

UNIT-I

Introduction to Operations Research

Basics of operations research: definition, history, and applications. Scope and limitations of operations research. Phases of the operations research process. Linear Programming. Formulation of linear programming problems. Graphical solution and simplex method. Duality and sensitivity analysis.

UNIT-II

Integer and Mixed-Integer Programming

Integer programming models and applications. Branch-and-bound algorithm for solving integer programming problems. Cutting-plane methods. Network Optimization. Shortest path and minimum spanning tree problems. Max flow-min cut theorem and applications. Transportation and assignment problems.

UNIT-III

Nonlinear Optimization

Unconstrained optimization techniques: gradient descent, Newton's method. Constrained optimization: Karush-Kuhn-Tucker conditions. Applications of nonlinear optimization in engineering.

Dynamic Programming

Principles of dynamic programming. Forward and backward recursion methods.
Applications in resource allocation and project scheduling.

UNIT-IV

Queuing Theory

Basics of queuing systems and models. M/M/1 and M/M/c queuing models. Applications of queuing theory in communication networks.

UNIT-V

Decision Analysis

Decision-making under uncertainty. Decision trees and expected value of perfect information. Sensitivity analysis and risk assessment.

Text Books

1. Frederick S. Hillier and Gerald J. Lieberman, Introduction to Operations Research, McGraw-Hill
2. Wayne L. Winston, Operations Research: Applications and Algorithms, Cengage Learning.

Reference Books

1. Hamdy A. Taha, Operations Research: An Introduction, Pearson
2. Ravindra K. Ahuja, Thomas L. Magnanti, and James B. Orlin, Network Flows: Theory, Algorithms, and Applications, Prentice Hall.

First Year (Semester –II)
Business Analytics

MTECVLSI204C	Business Analytics	OE	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. The objective of this course is to provide students with a comprehensive understanding of business analytics principles, methodologies, and techniques.
2. The course aims to equip students with the knowledge and skills required to analyze and interpret data, make data-driven decisions, and apply analytical techniques in communication technologies and related domains.

Course Outcomes:

After the completion of course, the student will able to

1. Understand the fundamental principles of business analytics.
2. Apply data visualization and statistical techniques to analyze and interpret data.
3. Evaluate and select appropriate analytical tools for various business scenarios.
4. Design and implement data-driven solutions to solve real-world problems.
5. Utilize their skills to optimize processes and enhance decision-making in communication systems.

UNIT-I

Introduction to Business Analytics

Basics of business analytics: definition, importance, and applications. Role of data in decision-making and business strategies. Ethical considerations in business analytics. Data Exploration and Visualization. Data preprocessing and cleaning. Exploratory data analysis. Data visualization techniques using tools like Tableau, Power BI, etc.

UNIT-II

Descriptive and Inferential Statistics

Measures of central tendency and dispersion. Hypothesis testing and confidence intervals. Analysis of variance (ANOVA) and regression analysis. Predictive Analytics. Regression analysis for prediction. Time series analysis and forecasting. Machine learning algorithms for predictive modeling.

UNIT-III

Prescriptive Analytics

Introduction to optimization and linear programming. Decision-making under uncertainty using decision trees and Monte Carlo simulation. A/B testing and experimental design. Text Analytics and Natural Language Processing (NLP). Basics of text analytics and sentiment analysis. Introduction to NLP techniques. Applications of NLP in business insights.

UNIT-IV

Data Mining and Machine Learning

Clustering and classification techniques. Feature selection and dimensionality reduction.

Introduction to machine learning algorithms.

UNIT-V

Emerging Trends in Business Analytics

Big data analytics and real-time insights. Ethical considerations in data-driven decision-making. Business analytics in the context of emerging technologies.

Text Books

1. Ramesh Sharda, Dursun Delen, Efraim Turban, Business Analytics, Pearson
2. Foster Provost and Tom Fawcett, Data Science for Business, O'Reilly Media

Reference Books

1. Venkat Reddy Konasani, Practical Business Analytics Using SAS: A Hands-On Guide, Apress.
2. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, McGraw-Hill

First Year (Semester –II)
Composite Materials

MTECVLSI204D	**Composite Materials**	**OE**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Understand characteristics of Composite materials
2. To understand manufacturing technique of composites

Course Outcomes:

After the completion of course, the student will able to

1. Demonstrate knowledge of composite materials
2. Ability to display preparation of molding compounds
3. Explore various metal diffusion techniques
4. Demonstrate methods of manufacturing molding compounds
5. Analyze stress and strain of material
6. Able to select proper material

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

Reinforcement

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 molding compounds and prepregs, hand layup method – Autoclave method – Filament winding method – Compression molding – Reaction injection molding. Properties and applications.

UNIT-V

Strength

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations. Application and case studies of different composite materials.

Text Books:

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

Reference Books:

1. Deborah D. L. Chung, Composite Materials Science and Applications.
2. K. K. Chawla, Composite Materials

First Year (Semester –II)
Industrial Safety

MTVLSIOE204E	Industrial Safety	OE	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. The objective of this course is to provide students with a comprehensive understanding of industrial safety principles, regulations, risk management, and best practices within the context of advanced communication technologies.
2. Students will learn how to identify, assess, and mitigate potential safety hazards in technology driven industrial environments, ensuring the well-being of employees, assets, and the surrounding environment.

Course Outcomes:

After the completion of course, the student will able to

1. Understand the importance of industrial safety in the context of advanced communication technologies.
2. Identify potential safety hazards associated with communication technology equipment and systems.
3. Apply risk assessment techniques to evaluate and prioritize safety risks.
4. Design safety protocols and measures for technology-driven industrial processes.
5. Develop contingency plans for emergencies and incidents.

UNIT-I

Introduction to Industrial Safety

Importance of industrial safety in technology-intensive industries. Historical accidents and their impacts. Regulatory frameworks and standards Hazard Identification and Risk Assessment. Common hazards in communication technology environments. Risk assessment methodologies. Quantitative and qualitative risk assessment techniques.

UNIT-II

Safety in Communication Technology Infrastructure

Safety considerations in data centers and network facilities. Electrical safety for advanced communication equipment. Fire prevention and control measures.

UNIT-III

Human Factors and Ergonomics

Understanding human error and its role in accidents. Designing user-friendly and safe workspaces Managing fatigue and stress in technology-intensive roles.

UNIT-IV

Emergency Planning and Incident Response

Developing emergency response plans. Evacuation procedures and protocols. Crisis communication strategies.

UNIT-V

Compliance and Regulations

Occupational Safety and Health Administration (OSHA) regulations, International safety standards for communication technologies. Ensuring compliance in a rapidly evolving technological landscape Case Studies and Best Practices. Analyzing past industrial accidents related to communication technologies. Learning from success stories in industrial safety.

Text Books

1. C. Ray Asfahl and David W. Rieske, Industrial Safety and Health Management.
2. E. Scott Geller, Principles of Safety

Reference Books

1. Wayne C. Turner and Richard D. Ryan, Introduction to Industrial and Systems Engineering
2. Roger L. Brauer, Safety and Health for Engineers
3. Introduction to Process Safety for Undergraduates and Engineers" by CCPS
4. (Center for Chemical Process Safety)

First Year (Semester –II)
Intellectual Property Rights

MTECVLSI205	Intellectual Property Rights	ELC	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.
2. To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right, trademarks, designs and information Technology Act.
3. Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's.

Course Outcomes:

After the completion of course, the student will able to

1. Know the process of drafting and filing patent.
2. Apply the knowledge of writing copyright for their innovative works.
3. Acquire the knowledge of plagiarism in their innovations which can be questioned legally.

UNIT-I

Introduction to IPR

Meaning of property, Origin, Nature, Meaning of Intellectual Property Rights, Introduction to TRIPS and WTO, Kinds of Intellectual property rights - Copy Right, Patent, Trade Mark, Trade; Secret and trade dress, Design, Layout Design, Geographical Indication, Plant. Varieties and Traditional Knowledge.

UNIT-II

Patent Rights

Origin, Meaning of Patent, Types, Inventions which are not patentable, Registration Procedure, Rights and Duties of Patentee, Assignment and license, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties.

UNIT-III

Copy Right

Origin, Definition, Types of Copy Right, Registration procedure, Assignment & license, Terms of Copy Right, Piracy, Infringement, Remedies, Copy rights with special reference to software.

UNIT-IV

Trade Marks

Origin, Meaning & Nature of Trade Marks, Types, Registration of Trade Marks, Infringement & Remedies, Offences relating to Trade Marks, Passing Off, Penalties. Domain Names on cyber space.

UNIT V

Design

Meaning, Definition, Object, Registration of Design, Cancellation of Registration, International convention on design, functions of Design. Semiconductor Integrated circuits and layout design Act-2000.

Textbooks / References:

1. Dr. G. B. Reddy, Intellectual Property Rights and the Law, Gogia Law Agency
2. Dr. B. L. Wadehra, Law relating to Intellectual Property, Universal Law Publishing Co.
3. P. Narayanan, IPR.
4. Dr. S. R. Myneni, Law of Intellectual Property, Asian Law House

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Intellectual Property & Rights	Prof. Feroz Ali	IIT Madras	https://onlinecourses.nptel.ac.in/noc23_hs55/preview

First Year (Semester –II)
PG Lab – III

MTECVLSI206	**PG Lab – III**	**PCC**	**0L- 0T - 2P**	**1 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 0hrs./week Tutorial: 0 hr./week Practical: 2hrs./week	Continuous Assessment: 25 Marks End Semester Exam: 25 Marks

Practical's of the PG Lab - III shall be based on the courses of second semester. The lab work shall consists of hands on experiments on the different software and hardware platforms related to the syllabus.

First Year (Semester –II)
PG Lab – IV

MTECVLSI207	**PG Lab – IV**	**PCC**	**0L- 0T - 2P**	**1 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 0hrs./week Tutorial: 0 hr./week Practical: 2hrs./week	Continuous Assessment: 25 Marks End Semester Exam: 25 Marks

Practical's of the PG Lab - IV shall be based on the courses of second semester. The lab work shall consists of hands on experiments on the different software and hardware platforms related to the syllabus.

First Year (Semester –II)
Indian Knowledge System (IKS): Concepts and Applications in Engineering

MTVLSIAE208A	**Indian Knowledge System (IKS): Concepts and Applications in Engineering**	**IKS**	**2L- 0T - 0P**	**2 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 2 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 25 Marks End Semester Exam: 25 Marks

Course Objectives:

1. Introduce students to the foundational concepts, philosophies, and components of Indian knowledge systems, including ancient scriptures, philosophies, and traditional practices.
2. Introduce students to Vedic mathematical principles and computational techniques from ancient Indian texts, demonstrating their practical use in engineering calculations.
3. Explore the potential benefits of incorporating yogic and meditative practices into engineering to enhance focus, creativity, and overall well-being.
4. Study architectural concepts from Indian traditions and evaluate how they can inform modern urban planning and sustainable architecture.
5. Encourage students to draw inspiration from IKS to develop innovative engineering solutions that align with ancient wisdom while meeting contemporary needs.

Course Outcomes:

After the completion of course, the student will able to

1. Gain a comprehensive understanding of the philosophical, scientific, and technological aspects of Indian Knowledge Systems and their historical development.
2. Understand the philosophical underpinnings of IKS, including concepts like dharma, karma, and holistic thinking, and explore their relevance to engineering.
3. Understand Vedic mathematical principles and computational methods, and their potential relevance in solving modern engineering problems.
4. Investigate the connections between yoga, meditation, and stress management, and their potential impact on mental well-being in engineering contexts.
5. Reflect on the ethical, cultural, and social dimensions of integrating IKS concepts into engineering practices and applications.

UNIT I

Indian Knowledge System – An Introduction & Vedic Corpus

What is IKS? Why do we need IKS? Organization of IKS, Historicity of IKS, Some salient aspects of IKS. Introduction to Vedas, A synopsis of the four Vedas, Sub-classification of Vedas, Messages in Vedas, Introduction to Vedāṅgas, Prologue on Śikṣā and Vyākaraṇa, Basics of Nirukta and Chandas, Introduction to Kalpa and Jyotiṣa, Vedic Life: A Distinctive Features.

UNIT II

Number system & Mathematics

Number systems in India - Historical evidence, Salient aspects of Indian Mathematics, Bhūta-Saṃkhyā system, Kaṭapayādi system, Measurements for time, distance, and weight, Piṅgala and the

Binary system.
Introduction to Indian Mathematics, Unique aspects of Indian Mathematics, Indian Mathematicians and their Contributions, Algebra, Geometry, Trigonometry, Binary mathematics, and combinatorial problems in Chandaḥ Śāstra, Magic squares in India

UNIT III
Engineering Technology: Metal & Other applications
Wootz Steel: The rise and fall of a great Indian technology, The Indian S & T heritage, Mining and ore extraction, Metals and metalworking technology, Iron and steel in India, lost wax casting of idols and artefacts, Apparatuses used for extraction of metallic components.
Irrigation systems and practices in South India, literary sources for science and technology, Physical structures in India, irrigation and water management, dyes and painting technology, the art of making perfumes, Surgical techniques, shipbuilding, sixty-four art forms (64 Kalās) status of Indigenous S & T.

UNIT IV
Town Planning and Architecture:
Perspective of Arthaśāstra on town planning, Vāstu-śāstra – The science of architecture eight limbs of Vāstu, town planning, temples in India: Marvelous stone architecture for eternity, temple architecture in India, Iconography.

UNIT V
Knowledge Framework and classifications:
Indian scheme of knowledge, The knowledge triangle, Prameya – A vaiśeṣikan approach to physical reality, Dravyas – the constituents of the physical reality, Attributes – the properties of substances and Action – the driver of conjunction and disjunction, Sāmānya, viśēṣa, samavāya, Pramāṇa – the means of valid knowledge, Saṃśaya – ambiguities in existing knowledge, Framework for establishing valid knowledge, Deductive or inductive logic framework, Potential fallacies in the reasoning process, Siddhānta: established tenets in a field of study.

UNIT VI
Linguistics
Introduction to Linguistics, Aṣṭādhyāyī, Phonetics, word generation, computational aspects, Mnemonics, Recursive operations, Rule based operations, Sentence formation verbs and prefixes, role of Sanskrit in natural language processing.

Textbooks / References:
1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd. Delhi.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Indian Knowledge System (IKS): Concepts and Applications in Engineering	Prof. B. Mahadevan, Dr. Vinayak Rajat Bhat, Dr. R Venkata Raghavan	Prof. B. Mahadevan, Dr. Vinayak Rajat Bhat, Dr. R Venkata Raghavan	https://onlinecourses.swayam2.ac.in/imb23_mg53/preview

First Year (Semester –II)
Indian Knowledge System (IKS): Humanities and Social Sciences

MTVLSIAE208B	**Indian Knowledge System (IKS): Humanities and Social Sciences**	**IKS**	**2L- 0T - 0P**	**2 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 2 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 25 Marks End Semester Exam: 25 Marks

Course Objectives:

1. Introduce students to the diverse range of Indian philosophical, cultural, and social knowledge systems that have evolved over millennia.
2. Encourage students to critically compare Indian knowledge systems with other global philosophies and social theories, fostering a nuanced understanding.
3. Study Vedic texts, ancient scriptures, and philosophical treatises to understand the core ideas and insights that inform Indian knowledge systems.
4. Investigate the intersections of spirituality, psychology, and well-being in Indian knowledge systems, exploring practices like meditation, yoga, and mindfulness.
5. Study the role of language, symbols, and communication in Indian knowledge systems, including Sanskrit as a language of knowledge transmission.

Course Outcomes:

After the completion of course, the student will able to

1. Recognize the interdisciplinary nature of IKS, integrating traditional knowledge with contemporary concepts in humanities and social sciences.
2. Explore India's rich cultural heritage, including literature, art, music, dance, and rituals, and analyze their significance in shaping identity and social cohesion.
3. Explore Indian philosophical schools and their insights into consciousness, self- awareness, and psychological well-being.
4. Analyze India's cultural diversity, pluralism, and the coexistence of various belief systems, contributing to tolerance and social harmony.

UNIT I

Indian Knowledge System – An Introduction & Vedic Corpus

What is IKS? Why do we need IKS? Organization of IKS, Historicity of IKS, Some salient aspects of IKS, Introduction to Vedas, A synopsis of the four Vedas, Sub-classification of Vedas, Messages in Vedas, Introduction to Vedāṅgas, Prologue on Śikṣā and Vyākaraṇa, Basics of Nirukta and Chandas, Introduction to Kalpa and Jyotiṣa, Vedic Life: A Distinctive Features.

UNIT II

Philosophical Systems

An introduction to philosophical systems, development of philosophy unique features of philosophy, Sāṅkhya approach of philosophy, Introduction to Yoga, tenet of Nyāya philosophy principles of Vaiśeṣika, doctrine of Pūrva-Mīmāṃsā Darśana, thesis of Vedānta and synopsis of Advaita philosophy of Viśiṣṭādvaita.

UNIT III

Wisdom through ages

Gateways of ancestral wisdoms, introduction to Purāṇa, the Purāṇic repository, Issues of interest in Purāṇas, Introduction to Itihāsas, Key messages in Itihāsas, Wisdom through Nīti- śāstras, Wisdom through Subhāṣita.

UNIT IV

Health Wellness and Psychology:

Introduction to health, Āyurveda: approach to health, Sapta-dhātavaḥ: seven-tissues, role of agni in health, tri-doṣas, Āyurveda: definition of health, Psychological aspects of health, disease management elements, Dinacaryā: daily regimen for health & wellness, Importance of sleep, Food intake methods and drugs, Approach to lead a healthy life, Indian approach to psychology, the tri guṇa system & holistic picture of the individual, the Nature of Consciousness, consciousness studies and issues

UNIT V

Linguistics:

Introduction to Linguistics, Aṣṭādhyāyī, phonetics, word generation, computational aspects, mnemonics, recursive operations, rule-based operations, sentence formation, verbs and prefixes, role of Sanskrit in natural language processing.

UNIT VI

Governance and Public Administration:

Introduction to raja dharma, Arthaśāstra: a historical perspective, Elements of a kauṭilyan state, The king & the amātya, Janapada & durga, treasury and the state economy (Kośa), danda, Mitra, the administrative setup, relevance of Arthaśāstra, public administration in Epics.

Textbooks / References:

1. Mahadevan, B., Bhat Vinayak Rajat, Nagendra Pavana R.N. (2022), "Introduction to Indian Knowledge System: Concepts and Applications", PHI Learning Private Ltd. Delhi.
2. Pride of India: A Glimpse into India's Scientific Heritage, Samskrita Bharati, New Delhi.
3. Sampad and Vijay (2011). "The Wonder that is Sanskrit", Sri Aurobindo Society, Puducherry.
4. Acarya, P.K. (1996). Indian Architecture, Munshiram Manoharlal Publishers, New Delhi.
5. Kapoor Kapil, Singh Avadhesh (2021). "Indian Knowledge Systems Vol – I & II", Indian Institute of Advanced Study, Shimla, H.P.
6. Dasgupta,S. (1975). A History of Indian Philosophy- Volume 1, Motilal Banarsidass, New Delhi.

First Year (Semester –II)
Disaster Management

MTECVLSI209	Disaster Management	Audit Course	2L- 0T - 0P	0 Credits

Teaching Scheme	Examination Scheme
Lecture: 2hrs./week Tutorial: 0 hr./week	Continuous Assessment: -- End Semester Exam: --

Course Objectives:

1. Mastering strategies to manage disasters and ensure public safety during emergencies.
2. Identifying hazards, vulnerabilities, and crafting plans to reduce disaster impact.
3. Collaborative Skills: Working across disciplines to address complex disaster challenges.
4. Developing, improving, and implementing disaster management policies. Community Empowerment: Educating and engaging communities for proactive disaster readiness.

Course Outcomes:

After the completion of course, the student will able to

1. Understand the basic concept of disaster(s) and disaster management, their significance, and types.
2. Develop the analytical skills to study relationship between vulnerability, disasters, disaster prevention and risk reduction
3. Gain a preliminary understanding of approaches to Disaster Risk Reduction (DRR)
4. Empowered with the awareness of institutional processes in the country for Disaster Management

UNIT I

Disaster Management: Disaster and Disaster Management – Concepts, Issues Concerned with Disaster Management. Disaster Management: Phases of Disaster Management, Phases of Disaster Management Types of Disasters: Bhopal Disaster: A Case Study, Types of Disasters-An Introduction, Natural Disaster, Man-made Disaster

UNIT II

Types of Disasters: Slow onset Disasters & Rapid onset Disasters, Simple and Complex, Tsunami: A Case Study Disasters, Tsunami: A Case Study, Cyclone Phallin 2013: A Case Study

UNIT III

Disaster Management in India - An overview: Evolution of Disaster Management in India, Disaster and Disaster Management in India, National institute of Disaster Management, National Disaster Management Act 2005.

UNIT IV

Disaster Management in India -An Overview: The National Policy on Disaster Management, 2009. Refugee Problem: National Plan on Disaster Management 2016, Refugee Problems, Impact of Disaster on the lives of Refugees. Refugee Problem: Problems of Women and Children during disasters, Principles of Psychosocial Care, Issues and Recovery during Emergency. Refugee Problem: Relationship between Disasters, Development and Vulnerabilities, Relationship between Disasters, Development and Vulnerabilities.

UNIT V

Stakeholders in Disaster Relief Management: Para-Military Forces, Fire Services. Disaster Risk Reduction: Disaster Risk Reduction Strategies, Risk Reduction Preparedness Plans. Disaster Risk Reduction: Action Plans and Procedures, Early Warning Systems, Components of Disaster Relief, Factors contributing to Vulnerability. Disaster Risk Reduction: Disaster Risk Reduction – Master Planning for the Future, Capacity Building Rehabilitation measures and long-term reconstruction, Understanding Kerala Disaster 2018.

Textbooks / References:

1. Coppola D P, 2007. Introduction to International Disaster Management, Elsevier Science (B/H), London.
2. Manual on natural disaster management in India, M C Gupta, NIDM, New Delhi
3. An overview on natural & man-made disasters and their reduction, R K Bhandani, CSIR, New Delhi
4. World Disasters Report, 2009. International Federation of Red Cross and Red Crescent, Switzerland
5. Encyclopaedia of disaster management, Vol I, II and IIIL Disaster management policy and administration, S L Goyal, Deep & Deep, New Delhi, 2006
6. Encyclopaedia of Disasters – Environmental Catastrophes and Human Tragedies, Vol. 1 & 2, Angus M. Gunn, Greenwood Press, 2008
7. Disasters in India Studies of grim reality, Anu Kapur & others, 2005, 283 pages, Rawat Publishers, Jaipur.
8. Management of Natural Disasters in developing countries, H.N. Srivastava & G.D. Gupta, Daya Publishers, Delhi, 2006, 201 pages
9. Natural Disasters, David Alexander, Kluwer Academic London, 1999, 632 pages
10. Disaster Management Act 2005, Publisher by Govt. of India
11. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management NIDM Publications
12. High Power Committee Report, 2001, J.C. Pant
13. Disaster Mitigation in Asia & Pacific, Asian Development Bank
14. National Disaster Management Policy, 2009, GoI
15. Disaster Preparedness Kit, American Red Cross

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Disaster Management	Naveen Kumar Nanjundan	University Of Hyderabad	https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

Second Year (Semester –III)
Network Security & Cryptography

MTECVLSI301A	**Network Security & Cryptography**	**PEC**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. To imbibe good foundation of network security in students for implementation of new network security algorithms.
2. To understand different network models and the protocols used in each layer.
3. To acquire detailed approach of encryption decryption for the data to transmit
4. To understand the role of network security as a tool for protection of different network entities
5. To be able to accurately apply security algorithms to real world security issues.
6. To ensure windows and web browser security through implementation of various encryption standards.

Course Outcomes:

After the completion of course, the student will able to

1. Analyze attacks on computers and computer security.
2. Demonstrate knowledge of cryptography techniques
3. Illustrate various Symmetric and Asymmetric keys for Ciphers
4. Evaluate different Message Authentication Algorithms and Hash Functions.
5. Get acquainted with various aspects of E-Mail Security
6. Assimilate various aspects of Web Security

UNIT-I

Introduction to Cryptography and Network Security

Overview of cryptography and its historical context. Introduction, The need for security, Security approaches, Principles of security, Types of Security attacks, Security services, Security Mechanisms, A model for Network Security.

UNIT-II

Introduction, plain text and cipher text, substitution techniques, transposition techniques, encryption and decryption, symmetric and asymmetric key cryptography, stenography, key range and key size, possible types of attacks.

UNIT-III

Block Cipher principles & Algorithms (DES, AES, Blowfish), Differential and Linear Crypt analysis, Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption function, Key distribution, Asymmetric key Ciphers, Principles of public key crypto systems, Algorithms (RSA, Diffie Hellman, ECC).

UNIT-IV

Authentication requirements, Functions, Message authentication codes, Hash Functions, Secure hash algorithm, HMAC, CMAC, Digital signatures, knapsack algorithm, Authentication

Applications such as Kerberos, X.509 Authentication Service, Public – Key Infrastructure, Biometric Authentication. Pretty Good Privacy, S/MIME, IP security overview, IP Security architecture, Authentication Header, Encapsulating, Security payload, combining security associations, Key management.

UNIT-V

Web security considerations, Secure Socket Layer and Transport Layer Security, Secure electronic transaction, Intruders, Intrusion detection, password management, virus and related threats, Countermeasures, Firewall design principles, types of firewalls, SET Protocol. Emerging Trends in Cryptography and Network Security. Case study: Block chain technology and its security implications.

Text Books

1. William Stallings, "Cryptography and Network Security", Pearson Education
2. Atul Kahate, "Cryptography and Network Security", McGraw Hill, 3rd Edition.
3. C K Shymala, N Harini, Dr. T R Padmanabhan, "Cryptography and Network Security", Wiley India,1st Edition

Reference Books

1. Forouzan Mukhopadhyay, "Cryptography and Network Security", Mc Graw Hill, 2 nd Edition.
2. Mark Stamp, "Information Security, Principles and Practice", Wiley India, 2nd Edition.
3. W.M. Arthur Conklin, Greg White, "Principles of Computer Security", TMH, 4 th Edition.
4. Neal Krawetz, "Introduction to Network Security", CENGAGE Learning Distributor, 1st Edition.
5. Bernard Menezes, "Network Security and Cryptography", CENGAGE Learning Distributor, 1st 2. Edition

Second Year (Semester –III)
Physical Design Automation

MTECVLSI301B	**Physical Design Automation**	**PEC**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Understand the concepts of Physical Design Process such as partitioning, Floor-planning, Placement and Routing.
2. Discuss the concepts of design optimization algorithms and their application to physical design automation.
3. Understand the concepts of simulation and synthesis in VLSI Design Automation

Course Outcomes:

After the completion of course, the student will able to

1. Understand the relationship between design automation algorithms and Various constraints posed by VLSI fabrication and design technology
2. Adapt the design algorithms to meet the critical design parameters.
3. Identify layout optimization techniques and map them to the algorithms
4. Explore various algorithms for design automation
5. Understand planning and routing
6. Develop proto-type EDA tool and test its efficacy

UNIT-I

Introduction

VLSI design Cycle, Physical Design Cycle, Design Rules, Layout of Basic Devices, and Additional Fabrication, Design styles: full custom, standard cell, and gate arrays, field programmable gate arrays, sea of gates and comparison, system packaging styles, multi-chip modules. Design rules, layout of basic devices, fabrication process and its impact on physical design, interconnect delay, noise and cross talk, yield and fabrication cost.

UNIT-II

Algorithms

Factors, Complexity Issues and NP-hard Problems, Basic Algorithms (Graph and Computational Geometry): graph search algorithms, spanning tree algorithms, shortest path algorithms, matching algorithms, min-cut and max-cut algorithms, Steiner tree algorithms.

UNIT-III

Basic Data Structures

Atomic operations for layout editors, linked list of blocks, bin based methods, neighbor pointers, corner stitching, multi-layer operations.

UNIT-IV

Graph algorithms for physical design

Classes of graphs, graphs related to a set of lines, graphs related to set of rectangles, graph problems in physical design, maximum clique and minimum coloring, maximum k-independent set algorithm, algorithms for circle graphs.

UNIT-V

Partitioning algorithms

Design style specific partitioning problems, group migrated algorithms, simulated annealing and evolution, and Floor planning and pin assignment, Routing and placement algorithms.

Text Books:

1. Naveed Shervani, Algorithms for VLSI Physical Design Automation, 3rd Edition, Kluwer Academic, 1999.
2. Charles J Alpert, Dinesh P Mehta, Sachin S Sapatnekar, Handbook of Algorithms for Physical Design Automation, CRC Press, 2008

Reference Books:

1. S.M. Sait , H. Youssef, "VLSI Physical Design Automation", World scientific, 1999
2. M.Sarrafzadeh, "Introduction to VLSI Physical Design", McGraw Hill (IE), 1999

Second Year (Semester –III)
Reconfigurable Computing

MTECVLSI301C	Reconfigurable Computing	PEC	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. The objective of this course is to provide students with a comprehensive understanding of reconfigurable computing concepts, architectures, and design methodologies.
2. The course aims to equip students with the knowledge and skills required to design, implement, and optimize reconfigurable hardware systems using Field-Programmable Gate Arrays (FPGAs) and related technologies.

Course Outcomes:

After the completion of course, the student will able to

1. Understand the fundamental principles and concepts of reconfigurable computing
2. Analyze and evaluate different types of reconfigurable hardware architectures.
3. Design and implement reconfigurable systems using FPGAs.
4. Optimize and customize hardware designs for specific applications.
5. Apply their skills to solve real-world challenges in reconfigurable computing.
6. Stay updated with emerging trends and advancements in reconfigurable computing technologies.

UNIT-I

Introduction to Reconfigurable Computing

Basics of reconfigurable computing: definition and applications. Evolution of reconfigurable hardware technologies. Challenges and advantages of reconfigurable computing. Field-Programmable Gate Arrays (FPGAs). FPGA architecture and components. FPGA programming languages: VHDL. FPGA design flow and development tools.

UNIT-II

Reconfigurable Hardware Design Techniques

Sequential and combinational logic design on FPGAs. Design optimization and resource management. Timing constraints and performance analysis. Hardware Description Languages (HDLs). Introduction to VHDL. HDL-based design methodologies. Synthesis and simulation tools for HDLs.

UNIT-III

High-Level Synthesis (HLS)

Introduction to HLS and its advantages. C-based design and optimization. Mapping C using code to hardware HLS tools. Reconfigurable Computing Architectures: Configurable logic blocks and interconnects. Partial and dynamic reconfiguration techniques. Coarse-grained and fine-grained reconfigurable architectures.

UNIT-IV

Reconfigurable Computing Applications

Hardware acceleration for compute-intensive tasks. Digital signal processing on FPGAs. Reconfigurable computing in cryptography, networking, and image processing.

UNIT-V

Reconfigurable Systems for Machine Learning

FPGA-based accelerators for neural networks. Hardware-software co-design for AI applications. FPGA-based inference engines.

Text Books:

1. Scott Hauck and André DeHon, Reconfigurable Computing: The Theory and Practice of FPGA-Based Computation, Morgan Kaufmann.
2. Field-Programmable Gate Arrays" by Stephen Brown and Jonathan Rose, Springer.

Reference Books

1. Pong P. Chu, Wiley, FPGA Prototyping by VHDL Examples: Xilinx Spartan-3 Version
2. David Harris and Sarah Harris, Digital Design and Computer Architecture, Morgan Kaufmann.

Second Year (Semester –III)
VLSI Sub-system Design

MTECVLSI301D	VLSI Sub-system Design	PEC	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Understand data processing elements with various architecture design
2. Acquire PLA design concepts
3. To understand memory design with its clock issues.

Course Outcomes:

After the completion of course, the student will able to

1. Acquire knowledge to Design of Data Processing Elements.
2. Design of Control Part of digital logic circuit.
3. Understand control part of VLSI subsystem.
4. Acquire knowledge about Structuring of Logic Design.
5. Understand architecture of memory.
6. Identify Clocking Issues in digital system design.

UNIT-I

Introduction

Review of Transistor, Inverter Analysis, CMOS Process and Masking Sequence, Layer Properties and Parasitic Estimation. VLSI Design Flow, Design Methodologies, Abstraction Levels.

UNIT-II

Design of Data Processing Elements

Adder Architectures, Multiplier Architectures, Counter Architectures, ALU Architectures, Design of Storage Elements: Latches, Flip-Flops, Registers, Register Files.

Design of Control Part

Moore and Mealy Machines, PLA Based Implementation, Random Logic Implementation, Micro-programmed Implementation.

UNIT-III

Structuring of Logic Design

PLA Design, PLA Architectures, Gates Array Cell Design, Concept of Standard Cell Based Design, Cell Library Design.

UNIT-IV

Memory Design

SRAM cell, Various DRAM cells, RAM Architectures, Address Decoding, Read/Write Circuitry, Sense Amplifier and their Design, ROM Design.

UNIT-V

Clocking Issues

Clocking Strategies, Clock Skew, Clock Distribution and Routing, Clock Buffering, Clock

Domains, Gated Clock, Clock Tree. Synchronization Failure and Meta-stability.

Text Books:

1. Weste, N. H. E. and Eshragian, K., Principles of CMOS VLSI Design – A Systems Prespective, Addison Wesley (1994) 3rd ed.
2. Rabaey, J. M., Chandrakasan, A., and Nikolic, B., Digital Integrated Circuits – A Design Perspective, Pearson Education (2008) 3rd ed

Reference Books:

1. Wolf, W., Modern VLSI Design, Prentice Hall (2008) 3rd ed.
2. Uyemura, J.P., Circuit design for CMOS VLSI, Springer (2005) 2nd ed.
3. Mead, C. and Conway, L., Introduction to VLSI Systems, B.S. Publisher (1980) 2nd ed

Second Year (Semester –III)
Fault Tolerant Digital System Design

MTECVLSI301E	Fault Tolerant Digital System Design	PEC	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Understand basics of fault and error models in VLSI arithmetic
2. Understand fault tolerance strategies, detection and correction techniques
3. To understand applications of arithmetic units and systems.

Course Outcomes:

After the completion of course, the student will able to

1. Acquire knowledge about fault tolerance in arithmetic circuits
2. Learn about Fault diagnosis, Fault tolerance measurement.
3. Acquire knowledge about Fault tolerance strategies
4. Enhance capabilities about applications of fault tolerant designs in arithmetic units and systems.
5. Acquire knowledge about IEEE test access methods.

UNIT-I

Fault Tolerant Design

Basic concepts: Reliability concepts, Failures & faults, Reliability and Failure rate, Relation between reliability and mean time between failure, maintainability and availability, reliability of series, parallel and parallel-series combinational circuits. Fault Tolerant Design: Basic concepts-static, dynamic, hybrid, triple modular redundant system (TMR), 5MR reconfiguration techniques, Data redundancy, Time redundancy and software Redundancy concepts.

UNIT-II

Self-Checking circuits & Fail safe Design

Self-Checking Circuits: Basic concepts, Design of Totally self-checking checker, Checkers using m out of n codes, Berger code, Low cost residue code. Fail Safe Design: Strongly fault secure circuits, fail safe design of sequential circuits using partition theory and Berger code, totally self-checking PLA design.

UNIT-III

Design for Testability

Design for testability for combinational circuits: Basic concepts of Testability, Controllability and observability, The Reed Muller's expansion technique, use of control and syndrome testable designs. Design for testability by means of scan: Making circuits Testable, Testability Insertion, Full scan DFT technique- Full scan insertion, flip-flop Structures, Full scan design and Test, Scan Architectures full scan design, Shadow register DFT, Partial scan methods, multiple scan design, other scan designs.

UNIT-IV

Logic Built-in-self-test

BIST Basics-Memory-based BIST,BIST effectiveness, BIST types, Designing a BIST, Test Pattern Generation-Engaging, BIST architectures-BIST related terminologies, A centralized and separate Board-

level BIST architecture, Built-in evaluation and self-test(BEST), Random Test socket(RTS), LSSD On-chip self-test, Self – testing using MISR and SRSG, Concurrent BIST, BILBO.

UNIT-V

Standard IEEE Test Access Methods

Boundary Scan Basics, Boundary scan architecture- Test access port, Boundary scan registers, TAP controller, the decoder unit, select and other units, Boundary scan Test Instructions-Mandatory instructions, Board level scan chain structure-One serial scan chain, multiple-scan chain with one control test port, multiple-scan chains with one TDI Multiple-scan chain, multiple access port, RT Level boundary scan-inserting boundary scan test hardware for CUT, Two module test case, virtual boundary scan tester, Boundary Scan Description language.

Text Books:

1. Parag K. Lala, "Fault Tolerant & Fault Testable Hardware Design", 1984, PH
2. Zainalabedin Navabi, "Digital System Test and Testable Design using HDL models and Architectures", Springer International Edition

Reference Books:

1. Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, "Digital Systems Testing and Testable Design", Jaico Books
2. Bushnell & Vishwani D. Agarwal, "Essentials of Electronic Testing", Springer.

Second Year (Semester –III)
Student Psychology

MTVLSIOE302A	**Student Psychology**	**OE**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Gain an understanding of prominent learning theories and models, enabling you to grasp the foundational concepts that influence effective teaching and learning.
2. Acquire skills to assess and appreciate diverse student characteristics, including learning styles, cultural backgrounds, and individual differences that impact learning.
3. Gain proficiency in understanding, administering, and interpreting psychological tests and inventories to assess cognitive abilities, personality traits, and emotional development in learners.
4. Examine psychological theories of motivation and cultivate the skills needed to apply motivational strategies that enhance student engagement, commitment, and achievement.
5. Investigate the stages of physical, cognitive, emotional, and social development in individuals, equipping you to design instructional methods that support comprehensive growth.
6. Acquire an understanding of NLP concepts and techniques that can be used to improve communication, establish rapport, and optimize teaching and learning experiences.

Course Outcomes:

After the completion of course, the student will able to

1. Understanding of Psychological Factors: Gain a comprehensive understanding of the psychological factors that influence students' learning, behaviour, and overall well- being in educational settings.
2. Recognition of Diverse Student Needs: Develop the ability to recognize and appreciate the diverse cognitive, emotional, and social needs of students, enabling tailored support and fostering inclusive learning environments.
3. Application of Psychological Strategies: Apply psychological theories and principles to address various challenges in student development, including motivation, learning difficulties, and behavioral issues.
4. Competence in Student Assessment: Acquire skills in utilizing psychological assessment tools to evaluate students' cognitive abilities, emotional states, and learning styles, informing instructional strategies and support plans.
5. Promotion of Positive Learning Experiences: Learn to create positive and conducive learning experiences by integrating insights from student psychology, fostering engagement, motivation, and holistic growth among learners.

UNIT I
Teaching Learning Process

UNIT II
Student Characteristics, Types and Problems

UNIT III
Psychological Tests and Inventories, Student Motivation

UNIT IV
Physical and Cognitive Development

UNIT V
Emotional and Social Development

Textbooks / References:

1. Sharma, R.A. (2007). Training Technology. Meerut: Surya Publications.
2. Sharma, R.A. (2007). Psychology of Teaching-Learning Process. Meerut: Surya Publications.
3. B.Mukhopadhyay(1997). Motivation in Educational Management. New Delhi: Sterling Publishers.
4. Barki & Mukhopadhyay. (1995). Guidance and Counselling. New Delhi: Sterling Publishers.
5. Agochya, D. (2010). Life competencies for adolescents. New Delhi: Sage Publications.
6. Davies, I.K. (1971). Management of Learning. Berkshire: McGraw Hill.
7. Dusay. (1980). Egograms. New York: harper & Row.
8. Goleman, D. (1996). Emotional Intelligence. New York: Bantom Books.
9. Anastasi. (2016). Psychological Testing. New Delhi: Pearson Education. Psychological Tests.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Student Psychology	Dr. S. Renukadevi	NITTTR, Chennai	https://onlinecourses.swayam2.ac.in/ntr19_ed23/preview

Second Year (Semester –III)
Business To Business Marketing (B2B)

MTECVLSI302B	**Business To Business Marketing (B2B)**	**OE**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Develop a comprehensive understanding of the unique characteristics, dynamics, and complexities that define business-to-business (B2B) marketing, including the role of intermediaries, supply chains, and collaborative relationships.
2. Learn how to segment B2B markets based on factors such as industry, company size, and purchasing behavior. Understand the significance of effective market segmentation in tailoring marketing strategies to specific B2B customer segments.
3. Explore the elements of the B2B marketing mix, including product/service offerings, pricing strategies, distribution channels, and promotional approaches. Develop the ability to design marketing strategies that align with the unique needs and preferences of B2B customers.
4. Gain insights into relationship-building strategies in B2B contexts. Learn how to nurture long-term, mutually beneficial partnerships with B2B clients through effective communication, trust-building, and value delivery.
5. Acquire skills in B2B sales processes, negotiations, and contract management. Understand the intricacies of negotiation dynamics, procurement processes, and key decision-making factors in B2B transactions.

Course Outcomes:

After the completion of course, the student will able to

1. Foundational Knowledge: Gain a strong grasp of the core concepts and theories that form the basis of B2B marketing, enabling practical application.
2. Market Analysis Expertise: Develop skills to analyse B2B markets, segment customers effectively, and make informed marketing decisions.
3. Strategic Implementation: Acquire the ability to design and execute B2B marketing strategies tailored to the unique needs of business customers.
4. Relationship Management: Learn how to build and nurture enduring relationships with B2B clients through effective communication and collaboration.
5. Sales and Negotiation Proficiency: Master the art of B2B sales, negotiation strategies, and contract management for successful transactions.

UNIT I

Introduction to B2B Marketing: Business marketing, Classifying goods for the business market, Business market customers, Market structure, Environment and Characteristics of Business Marketing, Strategic role of marketing, Commercial enterprises, Commercial and institutional customers, B2B vs B2C Marketing.

Organizational Buying and Buyer Behaviour: Organizational buyers‘ decision process - A Stepwise Model and A Process Flow Model, Organizational and business markets - Government as a customer - Commercial enterprises - Commercial and institutional customers, Value analysis,

Buygrid framework, Strategic procurement.

UNIT II

B2B Marketing Strategy: Strategy making and strategy management process, Industrial product strategy– Managing Products for Business Markets-Managing Services for Business Markets-Managing Business Market Channels the Growth-Share Matrix, Multifactor Portfolio Matrix, The Balanced Scorecard.

B2B Marketing STP: Market Segmentation, bases for segmenting business markets, basic framework of segmentation, choosing target segments and positioning.

UNIT III

Business Marketing Communications- B2B Advertising, Digital marketing, - Trade shows, exhibitions, business meets - Managing the sales force - Deployment analysis, Direct marketing

Demand forecasting: industrial market, Forecasting- meaning, importance and relevance, issues related to forecasting, forecasting measurement models, sales force forecasting, estimating segment demand, Collaborative approach to estimate demand, qualitative and quantitative forecasting methods.

UNIT IV

Product management: (existing and new) in industrial market, role of product in the industrial market, new product development, industrial product life cycle, product evaluation matrix, techniques for identifying new products QFD, perceptual mapping, reverse engineering, fish bone diagram, role of service and maintenance in industrial markets, customer experience life cycle, service quality.

Pricing: Pricing strategies; the pricing policy; Price on the Internet; Financial marketing, competitive bidding, commercial terms and conditions, role of leasing.

Buyer seller relationship, types of relationships, transactional and collaborative relationships, influencing industrial customers, role of service in industrial markets. CRM.

UNIT V

B2B marketing research, challenges in B2B research, developing a marketing information system, role of qualitative research techniques in B2B research.

Business marketing channels and participants - Channel design and management decisions - B2B logistics management, types of industrial middlemen and intermediaries, marketing logistics and physical distribution.

Strategic decision making in industrial markets, strategic planning at corporate levels, allocation of resources, portfolio analysis, developing SBU‘S objectives and goals, implementing and controlling marketing plan. Marketing through electronic commerce.

Textbooks / References:

1. James C. Anderson, Das Narayandas, James A. Narus and D.V.R. Seshadri, Business Market Management Understanding, Creating and Delivering Value, Pearson, 2010 3rd edition
2. Hutt and Speh, Business Marketing Management b2b, South-Western CENGAGE Learning 2013
3. Kotler and Pfoertsch, B2B Brand Management, Springer, 2006
4. Krishna K Havaldar, Business Marketing: Text and Cases, McGraw Hill Publications, 2014 4th edition.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Business To Business Marketing (B2B)	Prof. J. K. Nayak	IIT Roorkee	Business To Business Marketing (B2B) – Course (nptel.ac.in)

Second Year (Semester –III)
Organizational Behavior

MTECVLSI302C	Organizational Behavior	OE	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Explore how personality, motivation, perception, attitudes, and emotions impact employee performance and job satisfaction.
2. Study group formation, communication, decision-making, conflict resolution, and leadership's role in fostering teamwork.
3. Learn about the role of organizational culture in shaping behaviour, and develop skills to manage and align culture with goals.
4. Gain insights into leadership styles, communication, and team management for enhancing performance and satisfaction.
5. Navigate change, promote inclusivity, and address diversity-related challenges to cultivate adaptability and resilience in the workplace.

Course Outcomes:

1. Develop a grasp of how individual factors influence workplace behaviour, impacting job satisfaction and performance.
2. Acquire skills to foster productive group dynamics, facilitating better communication, decision-making, and conflict resolution.
3. Understand the role of organizational culture, and learn to manage and cultivate cultures aligned with organizational goals.
4. Gain insights into diverse leadership styles, enhancing the ability to manage teams and guide them towards success.
5. Develop the capacity to navigate change, promote diversity, and create an inclusive work environment, fostering resilience.

UNIT I

Introduction – a) defining organization, behavior and organizational behavior, b) assumptions of OB, c) principles of OB, d) levels of OB, e) scope of OB, f) OB and Human Resource Management, g) Applications of OB, h) Historical developments of OB, i) emerging concerns
Perception and Learning – a) understanding perception, b) Basic elements of perception, c) Principles of perceptual selection, d) Perceptual grouping, e) Social Perception, f) Self- perception and identity, g) attribution of causality, h) Perceptual biases in social perception, i) Implications for human resource management, j) defining learning, k) classical and operant conditioning l) learning in organizations.

UNIT II

Personality – a) Defining Personality, b) History of the concept, c) Key assumptions, d) biological and social determinants, e) Theories – Intrapsychic theory, social learning theory, self-theory, Trait, and type theories f) Related concepts (locus of control, dogmatism, authoritarianism, Machiavellianism), g) measuring personality.

Attitudes – a) Definition, b) Key elements of attitudes, c) Attitudes and related concepts (Values, opinion, belief, and ideology), e) Characteristics of attitudes, f) Attitude formation,
g) Attitude measurement, h) Changing attitudes, i) Attitudes at workplace (job satisfaction, work attitude and organizational commitment), j) Prejudice and discrimination at workspace.

UNIT III

Emotions in workplace - a) Definition, b) Types of emotions, c) Related concepts (mood, temperament), d) Stress in workplace, e) General Adaptation Syndrome, f) Managing Stress,
g) Psychosomatic disorders and stress h) emotional labor and emotional contagion. Motivation – a) Definition, b) Process of motivation, c) Types of motives, d) Motivators at workplace, e) Motivation theories (Process and Content theories).

UNIT IV

Interpersonal Dynamics – a) Definition, b) Psychological Contract, c) Trust and trust building, d) Prosocial behaviour, e) Cooperation Vs Competition f) Conflict management, g) Levels and types of conflict at workplace, h) Conflict management Styles, i) Managing Negotiations
Power and Leadership - a) Defining Power, b) Sources of Power, c) Organizational politics,
d) Leadership e) Managers Vs Leaders, f) Trait and Type approach to leadership g) Leadership style, h) Leadership Grid, i) Contingency Theories j) Contemporary issues

UNIT V

Organization Change – a) Change in Organizations, b) Nature of the chance process, c) Types of chance, d) Impact of change, e) Managing resistance to change, f) Organizational Development interventions
Organizational Structure and Design – a) Basic dimensions of structure, b) Departmentalization, c) Organizational life cycle, d) Organizations as socio-technical systems, e) Organizational design and its impact on employees, f) Organizational boundary spanning.

Textbooks / References:

1. Jerald Greenberg and Robert A. Baron, Behavior in Organizations, PHI learning private Ltd, New Delhi (Ninth Edition).
2. Udai Pareek, Understanding Organizational Behavior, Oxford University Press (Third Edition).
3. Nelson, Quick and Khandelwal, ORGB, Cengage Learning New Delhi (second edition).

NPTEL platform

NPTEL Course	Name of Instructor	Host Institute	Link
Organizational Behaviour	Prof. M. P. Ganesh	IIT Hyderabad	Organizational Behaviour – Course (nptel.ac.in)

Second Year (Semester –III)
Principles of Economics

MTECVLSI302D	Principles of Economics	OE	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Introduce essential economic terms and concepts for analysing real-world situations.
2. Understand market dynamics, supply and demand, and resource allocation.
3. Study national indicators, inflation, unemployment, and government policies' effects.
4. Learn to make informed choices using opportunity cost, utility, and cost analysis.
5. Explore global interdependencies, trade, exchange rates, and policy impacts.

Course Outcomes:

After the completion of course, the student will able to

1. Grasp key economic principles, like supply and demand, opportunity cost, and marginal analysis, forming a foundation for economic understanding.
2. Gain insights into market structures, pricing mechanisms, and factors influencing consumer and producer behaviour.
3. Understand the role of government interventions, regulations, and fiscal/monetary policies in shaping economic outcomes.
4. Learn how societies allocate scarce resources efficiently, exploring topics like production, distribution, and factors of production.
5. Develop analytical thinking by applying economic principles to real-world scenarios, making informed personal and business decisions.

UNIT I

Principles of Economics, Thinking like an Economist; Interdependence and the gains from Trade.

UNIT II

Market forces of supply and Elasticity, Application of elasticity; supply, demand, and government policies

UNIT III

Consumer and producer surplus; cost of taxation and international trade, Externalities, and cost of production

UNIT IV

Competitive market and monopoly market, Game theory and oligopoly, measures national income, measuring cost of living

UNIT V

Production and growth; Saving, Investment and the financial system, the monetary system, Money growth and inflation

Textbooks / References:

1. N. Gregory Mankiw, Principles of Economics.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Principles Of Economics	Prof. Sabuj Kumar Mandal	IIT Madras	Principles Of Economics – Course (nptel.ac.in)

Second Year (Semester –III)
Introduction to Public Administration

MTECVLSI302E	**Introduction to Public Administration**	**OE**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 0 hr./week Practical: 0 hrs./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Define public administration and explain its role in society.
2. Identify and analyze the different types of public organizations.
3. Apply public administration theories and principles to real-world problems.
4. Develop the skills and knowledge necessary to pursue a career in public administration.

Course Outcomes:

After the completion of course, the student will able to

1. Define public administration and explain its role in society.
2. Identify and analyze the different types of public organizations.
3. Apply public administration theories and principles to real-world problems.
4. Develop the skills and knowledge necessary to pursue a career in public administration.

UNIT – I

Public Administration: Meaning Nature, Scope and Significance of Public, Administration. Difference between Public and Private Administration, Administration as an Art or Science, New Public Administration, New Public Management, E-Governance: Concept, Rationale and significance.

UNIT – II

Theories of Organization – Classical, Neo classical and Modern theory, Approaches to the study of Public Administration: Structural – functional, systems, approach, Behavioral approach, Public Choice approach, Bureaucracy: Meaning types and Weberian model of Bureaucracy.

UNIT – III

Organization: formal and informal organizations, Principles of organization – Hierarchy, Span of control, unity of command and Coordination.

UNIT IV

Concepts of Public Administration: Power, Authority, and responsibility, Decision Making: Meaning, Classification and Essentials of decision making, Process of decision making, techniques of decision making, approaches to decision making.

UNIT – V

Good Governance: Concept, characteristics, elements. Issues and Challenges, Leadership:

Development of leadership, Qualities of leadership, Accountability, and control –Executive, Legislative, Judicial. Citizen and Administration: Issues and problems, Methods to promote good relationship.

References/Textbooks:

1. Felix, A. Nigro and C. Nigro Modern Public Administration (New York: Lloyd Harper and Row, Latest edition)
2. John Pfiffiner and Frank Sherwood Administrative Organization (New Delhi: Prentice Hall, Latest ed.).
3. Peter F. Drucker Management: Tasks, Responsibilities, and Practices (Bombay: Allied Publishers, latest ed.).
4. H. Koontz and Cyril O'Donnell Principles of Management, (Tokyo: McGraw Hill, latest ed).
5. Amitai Etzioni Modern Organizations (New Delhi: Prentice Hall, latest ed.).
6. Robert T. Golembiewsky Public Administration as a Developing Discipline (New York: Marcel, latest ed.).
7. Mohit Bhattacharya Public Administration (Calcutta: World Press, latest ed).
8. Mamta Mokta, S.S.Chauhan, S.K. Mahajan and Simmi Agnihotri Challenges in Governance(ed) Anamica Publishers,New Delhi 2011
9. C.P. Bhambri Public Administration (Theory and Practice (Meerut: Educational Publishers, latest ed.).
10. Bertram Gross The Managing of Organisations (London: Free Press, latest ed.).
11. W.M. Newman, C. Summer and E.Warren Management Concepts, behaviour & practice, edu. Publishers Meerut.
12. P. Herseay and K.H. Blanchard Management of Organisational Behaviour (New Delhi:latest ed.).
13. Nicholas Henry Public Administration and Public Affairs, (New Jersey: Prentice Hall, latest ed.).
14. Herbert G. Hicks and Ray C. Gutlet Organisations: Theory and Behaviour (New York: McGraw Hill, latest ed.).
15. Ramesh, K. Arora (ed.) Perspective in Administrative Theory (New Delhi: Associated, latest ed.).
16. S.L. Kaushik and Pardeep Sahni (eds.) Public Administration in India: Emerging Trends (Allahabad: Kitab Mehal, latest ed.).
17. J.S. Vickers and George K. Yarrow Privatization: An Economic Analysis (Cambridge: MIT Press, latest ed.).
18. David Osborne and T. Gaebler Re-inventing Government: How the Entrepreneurial Spirit is Transforming the Public Sector (New York: Addison Wesley, latest ed.).

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Introduction to Public Administration	By Prof. Y. Pardhasaradhi	Osmania University Hyderabad.	https://onlinecourses.swayam2.ac.in/cec21_hs06/preview

Second Year (Semester –III)
Digital Forensics

MTECVLSI303A	Digital Forensics	MDM	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Objective

1. To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
2. To understand how to examine digital evidences such as the data acquisition, identification analysis.

Outcome

After the completion of course, the student will able to

1. Know how to apply forensic analysis tools to recover important evidence for identifying computer crime.
2. To be well-trained as next-generation computer crime investigators.

UNIT -I

Computer forensics fundamentals, Benefits of forensics, computer crimes, computer forensics evidence and courts, legal concerns and private issues.

UNIT- II

Understanding Computing Investigations – Procedure for corporate High-Tech investigations, understanding data recovery work station and software, conducting and investigations.

UNIT-III

Data acquisition- understanding storage formats and digital evidence, determining the best acquisition method, acquisition tools, validating data acquisitions, performing RAID data acquisitions, remote network acquisition tools, other forensics acquisitions tools.

UNIT-IV

Processing crimes and incident scenes, securing a computer incident or crime, seizing digital evidence at scene, storing digital evidence, obtaining digital hash, reviewing case.

UNIT-V

Current computer forensics tools- software, hardware tools, validating and testing forensic software, addressing data-hiding techniques, performing remote acquisitions, E-Mail investigations- investigating email crime and violations, understanding E-Mail servers, specialized E-Mail forensics tool.

Text Books:

1. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 2nd ed., Thomson Course Technology, 2006, ISBN: 0-619-21706-5.
2. Warren G. Kruse II and Jay G. Heiser, "Computer Forensics: Incident Response Essentials", Addison Wesley, 2002.

Reference Books:

1. Vacca, J, *Computer Forensics, Computer Crime Scene Investigation*, 2nd Ed, Charles River Media, 2005, ISBN: 1-58450-389.

Second Year (Semester –III)
E-commerce Technologies

MTECVLSI303B	E-commerce Technologies	MDM	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Objectives:

1. To provide students with an overview and understanding of e-commerce with a specific emphasis on Internet Marketing.
2. To explore the major issues associated with e-commerce-security, privacy, intellectual property rights, authentication, encryption, acceptable use policies, and legal liabilities.

Outcomes:

After the completion of course, the student will able to

1. Obtain a general understanding of basic business management concepts.
2. Have complete knowledge about basic technical concepts relating to E-Commerce.
3. Obtain thorough understanding about the security issues, threats and challenges of E-Commerce.

UNIT – I

History of E-commerce and Indian Business Context

E-Commerce –Emergence of the Internet – Emergence of the WWW – Advantages of E-Commerce – Transition to E-Commerce in India – The Internet and India – E-transition Challenges for Indian Corporate. Business Models for Ecommerce: Business Model – E-business Models Based on the Relationship of Transaction Parties - E-business Models Based on the Relationship of Transaction Types.

UNIT – II

Enabling Technologies of the World Wide Web

World Wide Web – Internet Client-Server Applications –Networks and Internets – Software Agents – Internet Standards and Specifications – ISP. E-Marketing: Traditional Marketing – Identifying Web Presence Goals – Online Marketing – E-advertising – E-branding.

UNIT – III

E-Security

Information system Security – Security on the Internet – E-business Risk Management Issues – Information Security Environment in India. Legal and Ethical Issues : Cybers talking – Privacy is at Risk in the Internet Age – Phishing – Application Fraud – Skimming – Copyright – Internet Gambling – Threats to Children.

UNIT – IV

E-Payment Systems

Main Concerns in Internet Banking – Digital Payment Requirements – Digital Token-based e-payment Systems – Classification of New Payment Systems – Properties of Electronic Cash – Cheque Payment Systems on the Internet – Risk and e-Payment Systems – Designing e-payment Systems – Digital Signature – Online Financial Services in India - Online Stock Trading.

UNIT – V

Information systems for Mobile Commerce

What is Mobile Commerce? – Wireless Applications –Cellular Network – Wireless Spectrum – Technologies for Mobile Commerce – Wireless Technologies –Different Generations in Wireless Communication – Security Issues Pertaining to Cellular Technology. Portals for E-Business: Portals – Human Resource Management – Various HRIS Modules.

Text Book:

1. P.T.Joseph, S.J., "E-Commerce - An Indian Perspective", PHI 2012, 4th Edition.

Reference Books:

1. David Whiteley, "E-Commerce Strategy, Technologies and Applications", Tata McGraw Hill, 2001.
2. Ravi Kalakota, Andrew B Whinston, "Frontiers of Electronic Commerce", Pearson 2006, 12th Impression.

Second Year (Semester –III)
Modern Algebra

MTECVLSI303C	Modern Algebra	MDM	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Understand the fundamental principles of vector spaces and matrices.
2. Develop the ability to solve systems of linear equations using various methods.
3. Learn how to analyse and manipulate linear transformations and their properties.
4. Apply linear algebra concepts to solve real-world problems in fields such as physics, engineering, and computer science.

Course Outcomes:

After the completion of course, the student will able to

1. Demonstrate proficiency in performing matrix operations and solving linear equations in diverse mathematical contexts.
2. Apply linear algebra concepts to model and solve practical problems across multiple disciplines.
3. Analyse and interpret geometric transformations through the lens of linear transformations.
4. Develop critical thinking and problem-solving skills by using linear algebra as a foundation for advanced mathematical and scientific studies.

UNIT I

Vectors, vector spaces, span, linear independence, bases Dimension, linear transformations

UNIT II

Null spaces, range, coordinate bases Matrix multiplication, Invertibility, Isomorphisms

UNIT III

Coordinate change, products and quotients of vector spaces, duality Review of elementary row operations, rank, and determinants

UNIT IV

Eigenvalues, Eigenvectors Diagonalization

UNIT V

Characteristic polynomials, inner products, and norms Orthogonal bases, orthogonalization, orthogonal complements Adjoints, normal and self-adjoint operators Spectral theorem for normal and self-adjoint operators

References/Textbooks:

1. Bhattacharya P.B., Jain S.K. and Nagpaul S.R., First Course in Linear Algebra, Wiley Eastern Ltd., 1991.
2. Friedberg S.H, Insel A.J. and Spence L.E., Linear Algebra, 4th Edition, Prentice-Hall of India, New Delhi, 2004.
3. Hoffman K. and Kunze R., Linear Algebra, 2nd Edition, Prentice-Hall of India, New Delhi, 2000.
4. Kalman D., A singularly valuable decomposition; the SVD of a matrix, The College Math. Journal, Vol .27, No.1, (1996).
5. Kumaresan, S., Linear Algebra-A Geometric approach, Prentice-Hall of India, New Delhi, 2001.
6. Lay D.C., Linear Algebra and Its application, 3rd edition, Pearson Education (Singapore) Pvt. Ltd., Delhi, 2003.

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Linear Algebra	Prof. Pranav Haridas	Kerala School of Mathematics	https://onlinecourses.nptel.ac.in/noc20_ma21/preview

Second Year (Semester –III)
Components and Applications of Internet of Things

MTECVLSI303D	**Components and Applications of Internet of Things**	**MDM**	**3L- 0T - 0P**	**3 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. The objective of this course is to learn about Basics of IoT, Components of IoT including Sensors and actuators, computing, and communication systems.
2. It will also cover IoT Protocols, Security of IoT, Cloud based design and AI/Deep learning-based analytics.

Course Outcomes:

After the completion of course, the student will able to

1. Identify IoT Components: Recognize and classify key components of IoT systems, including sensors, actuators, communication protocols, and data processing units.
2. Explore IoT Communication: Understand various wireless and wired communication technologies used in IoT networks and their suitability for different application scenarios.
3. Design IoT Applications: Create IoT solutions by integrating hardware and software components, demonstrating proficiency in prototyping, programming, and data handling.
4. Analyze Data from IoT Devices: Collect, analyze, and interpret data generated by IoT devices to extract meaningful insights and support informed decision-making.

UNIT I

Basics of IoT

Introduction to Internet of things, various sensors, and sensing techniques. Technological trends in IoT. Impact of IoT on society. Review of various IoT application domain including agriculture, healthcare, manufacturing, device management, and vehicle to vehicle communication and wearable computing devices.

UNIT II

Microcontroller and Interfacing Techniques for IoT Devices

Introduction to IoT and architecture layers, IoT smart devices, Typical embedded computing systems, Introduction to ARM architecture and programming method, embedded system development: a case study, Introduction to interfacing techniques.

UNIT III

IoT Protocols & Security

Networking and basic networking hardware. Networking protocols, Interaction between software and hardware in an IoT device. IoT components and technologies to secure systems and devices. Various security issues related to the IoT and security architectures. Hardware security threats and security vulnerabilities; protecting physical hardware

UNIT IV

Location Tracking

Introduction to device localization and tracking; different types of localization techniques: time-of-arrival (TOA) based, time-difference-of-arrival (TDOA) based, angle-of-arrival (AOA) based, received signal strength (RSS) based, Radio-Frequency Identification (RFID) based and fingerprinting based; Monte-Carlo tracking; Kalman filter based tracking; Cramer- Rao lower bound (CRLB) for device location estimator; Device diversity/heterogeneity issue in IoT networks.

UNIT V

Internet of Robotic Things (IoRT)

Introduction to stationary and mobile robots; Brief introduction to localization, mapping, planning, and control of robotic systems; Introduction to cloud-enabled robotics; Applications of IoT in robotics; Architectures for IoRT; Examples and case studies; Open issues and challenges.

Textbooks / References:

NPTEL platform:

NPTEL Course	Name of Instructor	Host Institute	Link
Components nd Applications of Internet of Things	Dr. Sanjoy Kumar Parida	Indian Institute of Technology Patna	https://onlinecourses.swayam2.ac.in/arp20_ap03/preview

Second Year (Semester –III)
Project Management

MTECVLSI304	Project Management	HSSM	3L- 0T - 0P	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs./week Tutorial: 0 hr./week	Continuous Assessment: 20 Marks Mid Semester Exam: 20 Marks End Semester Exam: 60 Marks

Course Objectives:

1. Discuss effective project management practices and skills and how projects should be properly managed.
2. Describe the different phases of the project life cycle and plan appropriate activities for each phase of the project life cycle

Course Outcomes:

After the completion of course, the student will able to

1. Discuss complete structure of project management and analyze the scope of project planning.
2. Identify different project selection methods.
3. Explain the importance of procurement and its techniques.
4. Define the guidelines required for project control and its controlling techniques.
5. Outline the basic idea of projects and its initial management.

UNIT-I

Introduction

Characteristics of a project types of projects, Project Management Body of Knowledge (PMBOK), role of project manager and his qualities, project organization and benefits, idea generation, needs of society, import substitution, project lifecycle, project charter, project sponsor.

Project Planning: Customer needs, stake holder concept, project scope, feasibility study and report, baseline plan, SWOT analysis, project organization structure and hierarchy, project teams, formation, attitude and aptitude.

UNIT-II

Structure

Project selection methods, breakeven analysis, DCF methods, project implementation, estimation, cost, price, value, scheduling, bar charts, network diagrams, PERT and CPM, schedule crashing, simple introduction to risk management, probability in project management, decision trees.

UNIT-III

Procurement

Vendor selection methods, JIT, supply chains, quality, quality circles, quality control and quality assurance, cause and effect analysis, ISO and concepts of total quality management and six sigma, resource planning and allocation, availability and constraints of resources, resource leveling and crashing.

UNIT-IV

Project Control

Project scope, project change request, and control of schedule, resources, cost and quality, project communications, channels, means, meetings, project reports, project audits Project evaluation,

project close-out reports, guidelines, audit reports, maintenance and shutdown projects, plant turn-around and brief introduction to replacement analysis

UNIT-V

Projects

Contour maps, sitemaps, plant layout, suitability of project site, preparation of site, selection and leasing of construction equipment special considerations in selection and location of projects, safety, health, human and environment al factors, project finance, international projects, joint ventures, collaborations, impact of culture, implementation, and handing over of projects.

Text Book:

1. Kamaraju Ramakrishna, "Essentials of Project Management", PHI Learning, New Delhi, 2010.

References:

1. Prasanna Chandra, "Projects – Planning, analysis, selection, implementation and review", Tata McGraw-Hill, New Delhi, 2010.
2. Chitkara, "Construction Project Management", Tata McGraw- Hill, New Delhi.
3. Harold Kerzner, "Project Management", Wiley, New York.

Second Year (Semester –III)
Project – I

MTECVLSI305	Project - I	ELC	0L- 0T - 0P	10 Credits

Teaching Scheme	Examination Scheme
Lecture: 0 hrs./week Tutorial: 0 hr./week Practical: 0 hrs./week	Continuous Assessment: 50 Marks End Semester Exam: 50 Marks

Project-I is an integral part of the final project work. In this, the student shall complete the partial work of the project which will consist of problem statement, literature review, project overview, scheme of implementation that may include mathematical model/SRS/UML/ERD/block diagram/ PERT chart, and layout and design of the proposed system/work. As a part of the progress report of project-I work; the candidate shall deliver a presentation on progress of the work on the selected dissertation topic.

It is desired to publish the paper on the state of the art on the chosen topic in international conference/ journal.

The student shall submit the duly certified progress report of project -I in standard format for satisfactory completion of the work duly signed by the concerned guide and head of the department/institute.

Second Year (Semester –IV)
Project – II

MTVLSIPR401	**Project - II**	**ELC**	**0L- 0T - 0P**	**20 Credits**

Teaching Scheme	**Examination Scheme**
Lecture: 0 hrs./week Tutorial: 0 hr./week Practical: 0 hrs./week	Continuous Assessment: 100 Marks End Semester Exam: 100 Marks

In Project - II, the student shall complete the remaining part of the project which will consist of the simulation/ analysis/ synthesis/ implementation / fabrication of the proposed project work, work station, conducting experiments and taking results, analysis and validation of results and drawing conclusions.

It is mandatory to publish the paper on the state of the art on the chosen topic in international conference/ journal.

The student shall prepare the duly certified final report of project work in standard format for satisfactory completion of the work duly signed by the concerned guide and head of the department/institute.