B. Tech (VLSI Design & Technology)

Curriculum for Semester III [Second Year]

Sr. No.	Course Code	Course Title	Hours Per Week			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
1	BTBS301	Engineering Mathematics - III	3	1	-	20	20	60	100	4
2	BTVTC302	Electronic Device & Circuits	3	-	-	20	20	60	100	3
3	BTVTC303	Digital System Design	3	1	-	20	20	60	100	4
4	BTVTC304	Signals and Systems	3	-	-	20	20	60	100	3
5	BTVTC305	Network Theory	3	-	-	20	20	60	100	3
6	BTVTL306	Electronic Device & Circuits & Digital System Design Lab	-	-	2	60	-	40	100	2
7	BTVTS307	Seminar I	-	-	2	60	-	40	100	2
8	BTES211P	Internship - 1	-	-	-	-	-	-	-	Audit
		Total	**15**	**02**	**04**	**220**	**100**	**380**	**700**	**21**

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Curriculum for Semester IV [Second Year]

Sr. No.	Course Code	Course Title	Hours Per Week			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
1	BTVTC401	System Design through Verilog	3	-	-	20	20	60	100	3
2	BTVTC402	Microcontrollers and Computer Architecture	3	1	-	20	20	60	100	4
3	BTVTC403	Analog and Digital Communication	3	-	-	20	20	60	100	3
4	BTVTC404	Introduction to Micro fabrication	3	-	-	20	20	60	100	3
5	BTVTC405	Introduction to VLSI lifecycle	1	-	-	20	20	60	100	1
6	BTVTPE406	(A) Probability Theory and Random Processes (B) Analog Circuits (C) Problem solving through programming in C (D) Object oriented programming through C++	3	1	-	20	20	60	100	4
7	BTVTL407	System Design throughVerilog & Microcontrollers Lab	-	-	4	60	-	40	100	2

8	BTVTS408	Seminar II	-	-	4	60	-	40	100	2
9	BTVTP409 (Internship – 2)	Field Training / Internship / Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at onetime).	-	-	-	-	-	-	-	Audit (evaluation will be in V sem)
		Total	**16**	**02**	**08**	**240**	**120**	**440**	**700**	**22**

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Curriculum for Semester V [Third Year]

Sr. No.	Course Code	Course Title	Hours Per Week			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
1	BTVTC501	Electromagnetic Field Theory	3	1	0	20	20	60	100	4
2	BTVTC502	CMOS Design	3	1	0	20	20	60	100	4
3	BTVTC503	VLSI Design	3	1	0	20	20	60	100	4
4	BTVTPE504	PEC-2	3	1	0	20	20	60	100	4
5	BTVTOE505	OEC-1	3	1	0	20	20	60	100	4
6	BTVTTL506	CMOS Design lab	-	-	4	60	-	40	100	2
7	BTVTM507	Mini Project – 1	-	-	4	60	-	40	100	2
8	BTVTP508	Internship – 2 Evaluation	-	-	-	-	-	-	-	Audit
		Total	**15**	**5**	**8**	**220**	**100**	**380**	**700**	**24**

PEC-2	OEC-1
(A) Digital Signal Processing	(A) Control System Engineering
(B) Control Systems	(B) Artificial Intelligence and Machine learning
(C) Embedded Systems	(C) Optimization Techniques
(D) Mixed Signal Design	(D) Project Management and Operation Research
(E) System on Chip	(E) Augmented, Virtual and Mixed Reality

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Curriculum for Semester VI [Third Year]

Sr. No.	Course Code	Course Title	Hours Per Week			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
1	BTVTC601	VLSI Verification and Testing	3	1	-	20	20	60	100	4
2	BTVTC602	Semiconductor Equipment Design and Technology	3	1	-	20	20	60	100	4
4	BTVTPE603	PEC-III	3	1	-	20	20	60	100	4
5	BTVTOE604	OEC -II	3	1	-	20	20	60	100	4
6	BTHM605	Employability and Skill Development	3	-	-	60	-	40	100	3
7	BTVTL606	VLSI Verification and Testing lab	-	-	4	60	-	40	100	2
8	BTVTM607	Mini Project – 2	-	-	4	60	-	40	100	2
9	BTVTP608	Field Training // Internship /Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at one time).	-	-	-	-	-	-	-	Audit
		Total	**15**	**4**	**8**	**220**	**100**	**380**	**700**	**23**

PEC-III	OEC-II
(A) Analog IC Design	(A) Computer Network
(B) Semiconductor Device Modeling	(B) IoT and Industry 4.0
(C) Semiconductor Optoelectronics	(C) Patents and IPR
(D) Low Power VLSI Design	(D) ASIC Design
(E) Soft Computing and Optimization Techniques	(E) Research Methodology
(F) SoC Verification and Validation	(F) Open Source Technologies

B. Tech (VLSI Design & Technology)

Curriculum for Semester VII [Third Year]

Sr.	Course Code	Course Title	Hours Per Week			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
1	BTVTC701	Semiconductor Materials Synthesis and Characterization	3	1	0	20	20	60	100	4
2	BTVTPE702	PEC-IV	3	1	0	20	20	60	100	4
3	BTVTCOE703	OEC-IV	3	1	0	20	20	60	100	4
4	BTVTPE704	PEC-V	3	1	0	20	20	60	100	4
5	BTHM705	Engineering Economics and Financial Mathematics	3	1	0	20	20	60	100	4
6	BTHM706	Foreign Language Studies	–	–	4	60	-	40	100	2
7	BTVTL707	PEC Lab	–	–	4	60	-	40	100	2
8	BTVTM708	Mini Project – 3								
9	BTVTP709	Internship – 2 Evaluation	–	–	–	-	-	-	-	Audit
Total			**15**	**5**	**8**	**220**	**100**	**380**	**700**	**24**

PEC-IV	OEC-IV	PEC-V
(A) Digital CMOS VLSI Design	(A) Wireless Sensor Networks	(A) Quantum Mechanics for Engineers
(B) Hardware Software Co-Design for FPGA	(B) Entrepreneurship Development	(B)Image and Video Processing
(C) VLSI Architectures for Image Processing	(C) E Waste Management	(C) Advanced SoC Design Concepts
(D) System Verilog	(D) Data Structure & Algorithms Using Java Programming	(D) Advanced CMOS Fabrication
(E) Analog Integrated Circuit Design	(E) Fiber Optic Communication	(E) Digital VLSI Testing and Testability

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Curriculum for Semester VII [Third Year]

Sr.	Course Code	Course Title	Hours Per Week			Evaluation Scheme				Credits
			L	T	P	CA	MSE	ESE	Total	
1	BTVTP801	Project work/ Internship	-	-	24	60	-	40	100	12
Total			-	-	24	60	-	40	100	12

Semester III

BTBS301	Engineering Mathematics - III	4 Credits

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Linear differential equations of higher order using analytical methods and numerical methods applicable to Control systems and Network analysis.
2. Transforms such as Fourier transform, Laplace transform and applications to Communication systems and Signal processing.
3. Vector differentiation and integration required in Electro-magnetic and Wave theory.
4. Complex functions, conformal mappings, contour integration applicable to Electrostatics, Digital filters, Signal and Image processing

Course Outcomes:

On completion of the course, students will be able to:

1. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
2. Solve problems related to Fourier transform, Laplace transform and applications to Communication systems and Signal processing.
3. Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.
4. Perform vector differentiation and integration, analyze the vector fields and apply to Electromagnetic fields.
5. Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

UNIT - 1

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n , scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

UNIT - 2

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

UNIT - 3

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Perceval‟s identity for Fourier Transforms.

UNIT - 4

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange‟s linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation (), and one dimensional wave equation

UNIT - 5

Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form ;Cauchy‟s integral theorem; Cauchy‟s integral formula; Residues; Cauchy‟s residue theorem (All theorems without proofs)

TEXT/REFERENCE BOOKS

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, NewDelhi.
2. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO.Pvt. Ltd., New Delhi.
3. A course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi Sarvate, "Electromagnetism", Wiley Eastern.
5. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, NewYork.

6. A Text Book of Engineering Mathematics by PeterO‟Neil, Thomson Asia Pte Ltd. , Singapore.
7. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., NewDelhi.
8. Integral Transforms and their Engineering Applications by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
9. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill , NewYork

General Instructions:

1. The tutorial classes in Engineering Mathematics-III are to be conducted batchwise. Each class should be divided into three batches for the purpose.

2. The internal assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.

The minimum number of assignments should be eight covering all topics.

BTVTC302	Electronic Device & Circuits	3 Credits

Course Objectives:

1. To introduce Static characteristics of ideal two terminals and three terminal devices.
2. To introduce semiconductor devices BJT, JFET and MOSFET, their characteristics, operations, circuits and applications.
3. To analyze and interpret BJT, FET and MOSFET circuits for small signal at low and high frequencies.
4. To simulate electronics circuits using computer simulation software and verify desired results

Course Outcomes:

On completion of the course, students will be able to:

On completion of the course, students will be able to:

1. Comply and verify parameters after exciting devices by any stated method.
2. Implement circuit and test the performance.
3.Analyze BJT, JFET and MOSFET for various applications.
4. Analyze Feedback amplifiers and oscillators.
5. Understand the principles of semiconductor Physics

6. Understand and utilize the mathematical models of semiconductor junctions and MOStransistors for circuits and systems.

UNIT - 1

Introduction to Semiconductor Physics: Review of Quantum Mechanics, Electrons in periodic Lattices ,E-k diagrams. Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility and resistivity; sheet resistance, design of resistors.

UNIT - 2

Generation and recombination of carriers; Poisson and continuity equation P-N junction characteristics, I-V characteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode

UNIT - 3

Bipolar Junction Transistor, I-V characteristics, Ebers-Moll Model, MOS capacitor, C-V characteristics, JFET and its characteristics, Pinch off voltage, Drain saturation current, JFET amplifiers, CS,CD,CG amplifiers ,their analysis using small signal JFET model ,Biasing the FET,TheFETasVVR

UNIT - 4

Overview of DMOSFET, EMOSFET, Power MOSFET, n MOSFET, p - MOSFET and CMOS devices, Handling precautions of CMOS devices, MOSFET as an Amplifier and Switch, Biasing in MOSFET, Small signal operation and models, Single stage MOS amplifier, MOSFET capacitances, CMOS Inverter, Comparison of FET with MOSFET and BJT w.r.t. to device and Circuit parameter

UNIT - 5

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

TEXT/REFERENCE BOOKS

1. 1. G. Streetman, and S. K. Banerjee, ―Solid State Electronic Devices,‖ 7th edition, Pearson,2014.

2. 2. D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education 3. S. M. Sze and K. N. Kwok, ―Physics of Semiconductor Devices,‖ 3rd edition, John Wiley &Sons, 2006.

3. Brijesh Iyer, S. L. Nalbalwar, R. Dudhe, "Electronics Devices & Circuits", Synergy Knowledge ware Mumbai, 2017.ISBN:9789383352616

4. C.T. Sah, ―Fundamentals of solid state electronics,‖ World Scientific Publishing Co. Inc, 1991.

5. Y. Tsividis and M. Colin, ―Operation and Modeling of the MOS Transistor,‖ Oxford Univ.Press, 2011.

6. A.K. Maini, N. Maini, All-in-One Electronics Simplified, Khanna Book Publishing, New Delhi, 2021.

7. A.K. Maini, Analog Electronics, Khanna Book Publishing, New Delhi, 2022.

BTVTC303	Digital System Design	4 Credits

Course Objectives:

1. The concept and theory of digital Electronics are needed in almost all electronics and telecommunication engineering fields and in many other engineering and scientific disciplines as well.
2. The main objective of this course is to lay the foundation for further studies in areas such as communication, VLSI, computer, microprocessor etc. One of the most important reasons for the unprecedented growth of digital electronics is the advent of integrated circuit.
3. This course will explore the basic concepts of digital electronics

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Design and analyze combinational logic circuits
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
3. Design & analyze synchronous sequential logic circuits
4. Use HDL & appropriate EDA tools for digital logic design and simulation

UNIT - 1

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De

Morgan„sTheorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables,

Binary codes, Code Conversion.

UNIT - 2

MSI devices like Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU.

UNIT - 3

Sequential Logic Design: Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

UNIT - 4

Logic Families and Semiconductor Memories: TTL NAND gate, Specifications, Noise margin,

Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing, Memory elements, Concept of Programmable logic devices like FPGA.

Logic implementation using Programmable Devices.

UNIT - 5

VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits..

TEXT/REFERENCE BOOKS

1. M.Morris Mano and Michel.D.Ciletti, Digital Design with an introduction to HDL, VHDL and Verilog, Sixth edition Pearson education
2. R. Anand, Digital System Design Using VHDL, Khanna Book Publishing Company.
3. R. Anand, Digital Electronics, Khanna Book Publishing Company.
4. R.P. Jain, ―Modern digital Electronics‖, Tata McGraw Hill, 4th edition, 2009.
5. Douglas Perry, ―VHDL‖, Tata McGraw Hill, 4th edition, 2002.
6. W.H. Gothmann, ―Digital Electronics- An introduction to theory and practice‖, PHI, 2nd edition ,2006.
7. D.V. Hall, ―Digital Circuits and Systems‖, Tata McGraw Hill, 1989

8. Charles Roth, ―Digital System Design using VHDL‖, Tata McGraw Hill 2nd edition 201

BTVTC304	Signals and Systems	3 Credits

Course Objectives:

1. To understand the mathematical description of continuous and discrete time signals and systems.
2. To classify signals into different categories.
3. To analyze Linear Time Invariant (LTI) systems in time and transform domains.
4. To build basics for understanding of courses such as signal processing, control system and communication.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Analyze different types of signals
2. Represent continuous and discrete systems in time and frequency domain using different transforms
3. Investigate whether the system is stable
4. Sampling and reconstruction of a signal
5. Understand mathematical description and representation of continuous and discrete time signals and systems.
6. Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system.
7. Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
8. Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s-domain.

UNIT - 1

Introduction and Classification of signals: Definition of signal and systems, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power, elementary signals used for testing: exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc

Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for DT), time scaling, time shifting and time folding. Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible

UNIT - 2

System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral using graphical method, Computation of convolution sum. Properties of convolution, properties of the system based on impulse response, step response in terms of impulse response.

UNIT - 3

Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

UNIT - 4

FT of standard CT signals, FT of standard periodic CT signals, Introduction to Fourier Transform of DT signals, Properties of CTFT and DTFT, Fourier Transform of periodic signals. Concept of sampling and reconstruction in frequency domain

UNIT - 5

The z-Transform for discrete time signals and systems- Eigen functions, region of convergence, z domain analysis.

The Laplace Transform, notion of Eigen functions of LSI systems, a basis of Eigen functions, region of convergence, poles and zeros of system, Laplace domain analysis, solution to differential equations and system behavior.

TEXT/REFERENCE BOOKS

1. R. Anand, Signals and Systems, Khanna Publishing House, 2019.
2. A.V. Oppenheim, A.S. Willsky and I.T. Young, "Signals and Systems", Prentice Hall, 1983.

3. R.F. Ziemer, W.H. Tranter and D.R. Fannin, "Signals and Systems - Continuous and Discrete", 4th edition, Prentice Hall, 1998.

4. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, c1998.

5. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.

6. Dr. S. L. Nalbalwar, A.M. Kulkarni and S.P. Sheth, "Signals and Systems", 2^{nd} Edition, Synergy Knowledgeware, 2017

BTVTC305	Network Theory	3 Credits

Course Objectives:

1. To learn about the basic laws of electric circuits as well as the key fundamentals of the communication channels, namely transmission lines.
2. To understand the need of simplification techniques of complicated circuits
3. To learn about the comprehensive insight into the principle techniques available for characterizing circuits, networks and their implementation in practice.
4. To learn about the use of mathematics, need of different transforms and usefulness of differential equations for analysis of networks.
5. To train the students for handling analog filter design through theory of NA along with practical, this is basic requirement of signal processing field.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand basics electrical circuits with nodal and mesh analysis.
2. Appreciate electrical network theorems.
3. Apply Laplace Transform for steady state and transient analysis.
4. Determine different network functions.
5. Appreciate the frequency domain techniques.

UNIT - 1

Basic nodal and mesh analysis, linearity, superposition and source transformation, source transformation and duality. The venin‟s, Norton‟s and maximum power transfer theorem, network topology

UNIT - 2

Transient Analysis: Source free RL and RC circuits, unit step forcing function, source free parallel and series RLC circuit, complete response of the RLC circuit, lossless LC circuit. Frequency Domain Analysis: The phasor concept, sinusoidal steady state analysis; AC circuit Analysis

UNIT - 3

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis,

analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

UNIT - 4

Two Port Networks: Z, Y, h and ABCD parameters, analysis of interconnected (magnetically coupled) two port, three terminal networks

UNIT - 5

State Variable Analysis: State variables and normal-form equations, matrix-based solution of the circuit equations. RL & RC Network Synthesis: Synthesis of one-port networks, transfer function synthesis, Introduction to band pass, low pass, high pass and band reject filters.

TEXT/REFERENCE BOOKS

1. Van, Valkenburg.; ―Network analysis‖; Prentice hall of India, 2000
2. Sudhakar, A., Shyammohan, S. P.; ―Circuits and Network‖; Tata McGraw-Hill New Delhi,1994
3. A William Hayt, ―Engineering Circuit Analysis‖ 8th Edition, McGraw-Hill Education
4. Ashfaq Husain, Networks and Systems, Khanna Book Publishing, 2021

Semester IV

BTVTC401	System Design through Verilog	3 Credits

Course Objectives:

1. To know the basic language features of Verilog HDL and the role of HDL in digital logic design.
2. To know the behavioural modeling of combinational and simple sequential circuits.
3. To know the behavioral modeling of algorithmic state machines.
4. To know the synthesis of combinational and sequential descriptions.
5. To know the architectural features of programmable logic devices.

Course Outcomes:

At the end of the course, the students will be able to

1. Demonstrate knowledge on HDL design flow, digital circuits design, switch de-bouncing, metastability, memory devices applications
2. design and develop the combinational and sequential circuits using behavioral modeling
3. solving algorithmic state machines using hardware description language
4. analyze the process of synthesizing the combinational and sequential descriptions
5. memorizing the advantages of programmable logic devices and their description in Verilog

UNIT - 1

Introduction to Logic Design with Verilog : Structural models of combination logic, logic simulation, design verification, test methodology, propagation delay, truth table models of combinational and sequential logic with Verilog modules, ports, gate types, gate delays, dataflow modelling, continuous assignments delays, expressions, operators, operands, operator types

UNIT - 2

Logic Design With Behavioral Models of Combinational And Sequential Logic : Behavioral modeling, data types for behavioral modeling, behavioral models of combinational logic, propagation delay and continuous assignments, lathes and level sensitive circuits in Verilog, cyclic behavioural models of flip flops and latches, cyclic behavior and edge detection, a comparison of styles for behavioral modeling..

UNIT - 3

Behavioral models of multiplexers, encoders and decoders data flow model of a lfsr machines with multicycle operations, algorithmic state machine charts for behavioral modeling, asmd charts, behavioural models of counters, shift registers and register files, switch debounce, metastability, synchronizers for asynchronous signals.

UNIT - 4

Introduction to synthesis : synthesis of combinational logic, synthesis of sequential logic with latches, synthesis of three state devices and bus interfaces, synthesis of sequential logic with flip flops, synthesis of explicit state machines registered logic.

UNIT - 5

Programmable logic devices, storage devices, programmable logic array programmable array logic, programmability of PLDs CPLDs.

TEXT/REFERENCE BOOKS

1. Michael D Ciletti - Advanced Digital Design with the VERILOG HDL, 2ND Edition, PHI, 2009.
2. Samir Palnitkar - Verilog HDL, 2nd edition, Pearson Education, 2003.
3. Stephen Brown and Zvonko Vranesic - Fundamentals of Digital Logic with Verilog, 2nd Edition, TMH, 2008.
4. Z Navabi - Verilog Digital System Design, 2nd Edition, McGraw Hill, 2005.

BTVTC402	Microcontrollers and Computer Architecture	4 Credits

Course Objectives:

1. To provide insight into architectural details of microprocessors.
2. To master the assembly language programming using concepts like assembler directives, procedures, macros, software interrupts etc.
3. To understand well the organization of 8085 and 8086 memory, addressing, address decoding concepts.

4. To provide the knowledge of interfacing 8086 with memory, I/O devices, 8255, keyboard etc
5. To understand the concept of Interrupts and their significance in 8086.
6. To study various hardware, software interrupts, Programmable Interrupt Controller etc
7. To provide the knowledge about aspects which differentiates the versions of microprocessors.

Course Outcomes:

At the end of the course, the students will be able to

1. Explain the functional units with respect to computer architecture
2. Develop simple programmes using 8085/8051 assembly language
3. Interface 8085 with peripherals using assembly language
4. Interface 8051 with peripherals using assembly language/C

UNIT - 1

Functional units of a computer, Von Neumann and Harvard computer architectures, CISC and RISC architectures. Processor Architecture – General internal architecture, Address bus, Data bus, control bus. Register set – status register, accumulator, program counter, stack pointer, general purpose registers. Processor operation – instruction cycle, instruction fetch, instruction decode, instruction execute, timing response, instruction sequencing and execution. Algorithms for binary multiplication and division. Fixed and floating-point number representation

UNIT - 2

Introduction to Microprocessor, Microprocessor architecture and its operations, Memory, Input & output devices, Logic devices for interfacing, The 8085 MPU, Example of an 8085 based computer, Memory interfacing. Basic interfacing concepts, interfacing output displays, interfacing input devices, Memory mapped I/O.

UNIT - 3

Data Transfer operations, Arithmetic operations, Logic Operations, Branch operation, addressing modes, writing assembly language programs, Programming techniques: looping, counting and indexing. Additional data transfer and 16 bit arithmetic instruction, Arithmetic operations related to memory, Logic operation: rotate, compare, counter and time delays.

Subroutines.Interrupts

UNIT - 4

8255 Programmable peripheral interface, interfacing keyboard and seven segment display, 8254 (8253) programmable interval timer, 8259A programmable interrupt controller, Direct Memory Access and 8237 DMA controller.

Microcontrollers and Embedded Processors. Architecture – Block diagram of 8051, Pin configuration, Registers, Internal Memory, Timers, Port Structures, Interrupts. Assembly Language Programming -Addressing Modes, Instruction set (Detailed study of 8051 instruction set is required).

UNIT - 5

Simple programming examples in assembly language. Interfacing with 8051 using Assembly language programming: LED, Seven segment LED display. Programming in C – Declaring variables, Simple examples – delay generation, port programming, code conversion. Interfacing of – LCD display, Keyboard, Stepper Motor, DAC and ADC -- with 8051 and its programming. 8051 Timers/Counters -Modes and Applications. Serial Data Transfer – SFRs of serial port, working, Programming the 8051 to transfer data serially

TEXT/REFERENCE BOOKS

1. Computer System Architecture, Mano M M , Prentice Hall India

2. 8085 Microprocessor Architecture, Applications and Programming, Ramesh S Gaonkar, Penram International

3. The 8051 microcontroller and Embedded systems, Muhammed Ali Mazidi & Janice Gill Mazidi, Pearson Education

BTVTC403	Analog and Digital Communication	3 Credits

Course Objectives:

1. To study the fundamental concept of the analog communication systems.
2. To analyze various analog modulation and demodulation techniques.
3. To know the working of various transmitters and receivers.
4. To understand the influence of noise on the performance of analog communication systems.
5. To acquire the knowledge about information and capacity.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Analyze and compare different analog modulation schemes for their efficiency and bandwidth
2. Analyze the behavior of a communication system in presence of noise
3. Investigate pulsed modulation system and analyze their system performance
4. Analyze different digital modulation schemes and can compute the bit error performance

UNIT - 1

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

UNIT - 2

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

UNIT - 3

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers

UNIT - 4

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion. Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying.

UNIT - 5

Digital Modulation tradeoffs. Optimum demodulation of digital signals over band-limited channels Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation

TEXT/REFERENCE BOOKS

1. Haykin S., "Communications Systems", John Wiley and Sons, 2001.

2. Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.

3. Taub H. and Schilling D.L., "Principles of Communication Systems‖, Tata McGraw Hill, 2001.

4. Wozencraft J. M. and Jacobs I. M., ``Principles of Communication Engineering",John Wiley,1965.

5. Barry J. R., Lee E. A. and Messerschmitt D. G., ``Digital Communication", Kluwer Academic Publishers, 2004.

6. Proakis J.G., ``Digital Communications", 4th Edition, McGraw Hill, 2000.

7. R. Anand, Communication Systems, Khanna Book Publishing Company, 2011.

BTVTC404	Introduction to Micro fabrication	3 Credits

Course Objectives:

At the end of this course students will demonstrate the ability to

1. Elucidate the CMOS process flow
2. Analyze various critical processing steps in microfabrication
3. Appreciate the advanced methods involved in IC fabrication.
4. Analyze the advancements in CMOS process fabrication with scaling in technology.

Course Outcomes:

At the end of this course students will be able to understand:

1. the principles behind the design and fabrication of both semiconductor and MEMs devices and the effect of processes on their performance;
2. a thorough understanding of the available fabrication technologies;
3. a good working knowledge of possible process architectures;
4. an appreciation of the process plant required to enable microfabrication of devices and systems.

UNIT - 1

History of IC"s; Operation & Models for Devices of Interest: CMOS and MEMS. Electronic Materials: Crystal Structures, Defects in Crystals, Si, Poly Si, Si Crystal Growth. Clean room and Wafer Cleaning: Definition, Need of Clean Room, RCA cleaning of Si..

UNIT - 2

Dry and Wet Oxidation, Kinetics of Oxidation, Oxidation Rate Constants, Dopant Redistribution, Oxide Charges, Device Isolation, LOCOS, Oxidation System.

Overview of Lithography, Radiation Sources, Masks, Photoresist, Components of Photoresist Optical Aligners, Resolution, Depth of Focus, Advanced Lithography: E-beam Lithography, X-ray Lithography, Ion Beam Lithography

UNIT - 3

Pre-Deposition and Drive-in Diffusion Modeling, Dose, 2-Step Diffusions, Successive Diffusion, Lateral Diffusion, Series Resistance, Junction Depth, Irvin‟s Curves, Diffusion System. Ion Implantation: Problems in Thermal Diffusion, Advantages of Ion Implantation, Applications in ICs, Ion Implantation System, Mask, Energy Loss Mechanisms, Depth Profile, Range & Straggle, Lateral Straggle, Dose, Junction Depth, Ion Implantation Damage, Post Implantation Annealing, Ion Channeling, Multi Energy Implantation

UNIT - 4

Physical Vapor Deposition: Thermal evaporation, Resistive Evaporation, Electron beam evaporation, Laser ablation, Sputtering Chemical Vapor Deposition: Advantages and disadvantages of Chemical Vapor deposition (CVD) techniques over PVD techniques, reaction types, Boundaries and Flow, Different kinds of CVD techniques: APCVD, LPCVD, Metalorganic CVD (MOCVD), Plasma Enhanced CVD etc

UNIT - 5

Anisotropy, Selectivity, Wet Etching, Plasma Etching, Reactive Ion Etching.

Overview of Interconnects, Contacts, Metal gate/Poly Gate, Metallization, Problems in Aluminum Metal contacts, Al spike, Electro migration, Metal Silicide‟s, Multi-Level Metallization, Planarization, Inter Metal Dielectric

TEXT/REFERENCE BOOKS

1. Silicon VLSI Technology, Plummer, Deal and Griffin ,1st Edition, Pearson Education,2009
2. Fundamental of Semiconductor Fabrication, Sze and May,2nd Edition, Wiley India, 2009
3. Silicon Process Technology, S K Gandhi,2nd Edition, Wiley India,2009

BTVTC405	Introduction to VLSI lifecycle	1 Credits

Course Objectives:

1. To understand VLSI fundamentals: Gain a solid grasp of VLSI technology, semiconductor materials, and the basics of transistor operation.
2. To Learn about the various stages of the VLSI design lifecycle, including specification, design, verification, synthesis, layout, and fabrication.
3. To Explore design methodologies: Introduce different VLSI design methodologies.

Course Outcomes:

1. At the end of this course students will demonstrate the ability to
2. Understand the intricacies in VLSI Design flow
3. Understand overall process of VLSI Design flow starting from system level all the way to the transistor level.

UNIT - 1

System & Architectural Design: Defining a system specification, performance analysis, cost analysis, identifying various functional blocks/modules; categorizing them in terms of digital, analog, RF and mixed signal blocks..

UNIT - 2

Functional verification, logic design: Verifying the functionality of blocks, behavioral description, logic minimization, synthesis, verification and testing

UNIT - 3

Circuit Optimization and Physical Design: Optimization of synthesized blocks for various performance metric, Introduction to placement and route, Layout Vs Schematic (LVS) verification, Design for Manufacturability

UNIT - 4

Tape Out: Post layout simulations, Process Voltage Testing, Process Design Kit, Design Rule Check, GDSII Metalorganic CVD (MOCVD), Plasma Enhanced CVD etc

UNIT - 5

Fabrication and Packaging: CMOS process flow, dicing, various types of packaging.

TEXT/REFERENCE BOOKS

1. Sneh Saurabh, "Introduction to VLSI Design flow", Cambridge University Press.

2. N. H. E. Weste and C. Harris, "Principles of CMOS VLSI Design: A System Perspective, 3rd Edition, Pearson Education 2007

3. M.Morris Mano and Michel.D.Ciletti, Digital Design with an introduction to HDL, VHDL and Verilog, Sixth edition Pearson education

BTVTPE406	**(A) Probability Theory and Random Processes**	**4 Credits**

Course Objectives:

1. To develop basic of probability and random variables.

2. The primary objective of this course is to provide mathematical background and sufficient experience so that the student can read, write, and understand sentences in the language of probability theory, as well as solve probabilistic problems in engineering and applied science.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand representation of random signals
2. Investigate characteristics of random processes
3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.

UNIT - 1

Definitions, scope and history; limitation of classical and relative-frequency-based definitions, Sets, fields, sample space and events; axiomatic definition of probability, Combinatorics: Probability on finite sample spaces, Joint and conditional probabilities, independence, total probability; Bayes‟ rule and applications

UNIT - 2

Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability density functions (pdf) and properties, Jointly distributed random variables, conditional and joint density and distribution functions, Function of one random variable, pdf of the function of one random variable; Function of two random variables; Sum of two independent random variables, Expectation: mean, variance and moments of a random variable, conditional expectation; covariance and correlation; independent,

UNIT - 3

Random vector: mean vector, covariance matrix and properties, Some special distributions: Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution, Vector-space representation of random variables, linear independence, inner product, Schwarz Inequality, Moment-generating functions, Bounds and approximations: Tchebysheff inequality and Chernoff Bound

UNIT - 4

Almost sure convergence and strong law of large numbers; convergence in mean square sense with examples from parameter estimation; convergence in probability with examples; convergence in distribution, Central limit theorem and its significance.

UNIT - 5

Random process: Probabilistic structure of a random process; mean, autocorrelation and auto - covariance functions, Stationarity: strict - sense stationary (SSS) and wide- sense stationary (WSS) processes, Autocorrelation function of a real WSS process and its properties, cross-correlation function, Ergodicity and its importance, Power spectral density, properties of power spectral density, cross- power spectral density and properties; auto- correlation function and power spectral density of a WSS random sequence, examples with white - noise as input; Examples of random processes: white noise process and white noise sequence; Gaussian process; Poisson process, Markov Process..

TEXT/REFERENCE BOOKS

1. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
2. A.Papoulis and S. Unnikrishnan Pillai, ``Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
3. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers,
5. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
6. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press

BTVTPE406	(B) Analog Circuits	4 Credits

Course Objectives:

1. To understand characteristics of IC and Op-Amp and identify the internal structure.
2. To introduce various manufacturing techniques.
3. To study various op-amp parameters and their significance for Op-Amp.
4. To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
5. To analyze and identify linear and nonlinear applications of Op-Amp

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the characteristics of diodes and transistors
2. Design and analyze various rectifier and amplifier circuits
3. Design sinusoidal and non-sinusoidal oscillators
4. Understand the functioning of OP-AMP and design OP-AMP based circuits
5. Design ADC and DAC

UNIT - 1

Introduction to operational amplifiers: The difference amplifier and the ideal operational amplifier models, concept of negative feedback and virtual short; Analysis of simple operational amplifier circuits; Frequency response of amplifiers, Bode plots. Feedback: Feedback topologies and analysis for discrete transistor amplifiers; stability of feedback circuits using Barkhausen criteria..

UNIT - 2

Linear applications of operational amplifiers: Inverting and non-inverting amplifier configurations, voltage follower, summing, averaging scaling amplifier, difference amplifier, integrator, differentiator, instrumentation amplifiers, and Active filters.

UNIT - 3

Non-linear applications of operational amplifiers: Comparators, clippers and clampers; Linearization amplifiers; Precision rectifiers; Logarithmic amplifiers, multifunction circuits and true rms convertors.design of gain stages and output stages, compensation

UNIT - 4

Waveform Generation: sinusoidal feedback oscillators; Relaxation oscillators, square triangle oscillators

UNIT - 5

Analog and Digital interface circuits: Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash type, Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc., V-F, I-V and V-I converter.

TEXT/REFERENCE BOOKS

1. A.V.N. Tilak, Design of Analog Circuits, Khanna Publishing House, 2022.
2. A.S. Sedra and K.C. Smith, Microelectronic Circuits, sixth edition, Oxford University Press
3. J.V. Wait, L.P. Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, McGraw Hill, 1992.
4. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988.
5. P. Horowitz and W. Hill, The Art of Electronics, 2nd edition, Cambridge University Press,
1989.
6. Paul R. Gray and Robert G.Meyer, Analysis and Design of Analog Integrated Circuits, John Wiley, 3rd Edition

BTVTPE406 (C) Problem solving through programming in C **4 Credits**

Course Objectives:

1. Elucidate the basic architecture and functionalities of a Computer
2. Apply programming constructs of C language to solve the real-world problems
3. Explore user-defined data structures like arrays, structures and pointers in implementing solutions to problems
4. Design and Develop Solutions to problems using modular programming constructs such as functions and procedures

Course Outcomes:

At the end of the course the student will be able to:

1. Elucidate the basic architecture and functionalities of a computer and also recognize the hardware parts.
2. Apply programming constructs of C language to solve the real world problem
3. Explore user-defined data structures like arrays in implementing solutions to problems like searching and sorting
4. Explore user-defined data structures like structures, unions and pointers in implementing solutions
5. Design and Develop Solutions to problems using modular programming constructs using functions

UNIT - 1

Computer generations, computer types, bits, bytes and words, CPU, Primary memory, Secondary memory, ports and connections, input devices, output devices, Computers in a network, Network hardware, Software basics, software types.

Basic structure of C program, executing a C program. Constant, variable and data types, Operators and expressions.

UNIT - 2

Managing Input and output operations. Conditional Branching and Loops. Example programs, finding roots of a quadratic equation, computation of binomial coefficients, plotting of Pascal‟s triangle

UNIT - 3

Arrays (1-D, 2-D), Character arrays and Strings, Basic Algorithms: Searching and Sorting Algorithms (Linear search, Binary search, Bubble sort and Selection sort).

UNIT - 4

User Defined Functions and Recursion. Example programs: Finding Factorial of a positive integer, GCD of two numbers and Fibonacci
sequence.

UNIT - 5

Structures, Unions and Pointers, Pre-processor Directives and Example Programs like Addition of two complex numbers using structures , compute the sum, mean and standard deviation of all elements stored in an array of N real numbers using pointers.

TEXT/REFERENCE BOOKS

1. Byron S Gottfried “Programming with C” Second edition, Tata McGrawhill, 2007 (Paper back)
2. R.G. Dromey, “How to solve it by Computer”, Pearson Education, 2008.
3. Kanetkar Y, “Let us C”, BPB Publications, 2007.
4. Hanly J R & Koffman E.B, “Problem Solving and Programm design in C”, Pearson Education, 2009.
5. E. Balagurusamy, “Programming with ANSI-C”, Fourth Edition,2008, Tata McGraw Hill.
6. Venugopal K. R and Prasad S. R, “Mastering „C‟”, Third Edition, 2008, Tata McGraw Hill.
7. B.W. Kernighan & D. M. Ritchie, “The C Programming Language”, Second Edition, 2001,
Pearson Education
8. ISRD Group, “Programming and Problem Solving Using C”, Tata McGraw Hill,2008.
9. Pradip Dey , Manas Ghosh, “Programming in C”, Oxford University Press, 2007.

BTVTPE406 (D) Object oriented programming through C++ 4 Credits

Course Objectives:

This course enables the students to know about

1. Object Oriented concepts, C++ language .

2. Classes & Objects, Inheritance, Polymorphism.

3. Templates , Streams, Files

Course Outcomes:

At the end of the course the student will be able to:

1. Understand OOPs Concept ,C++ language features. Able to Understanding and Applying various Datatypes, Operators, Conversions in program design.
2. Understand and Apply the concepts of Classes & Objects, friend function, constructors &destructors in program design.
3. Design & implement various forms of inheritance, String class, calling base class constructors.
4. Apply & Analyze operator overloading, runtime polymorphism, Generic Programming.
5. Analyze and explore various Stream classes, I/O operations and exception handling.

UNIT - 1

Object Oriented paradigms, Data abstraction/control abstraction, OOPS principles, Origin of C++, Sample C++ program, dynamic initialization of variables , new and delete operators, C++ keywords, General form of C++ program, Type casting, Introducing C++ classes, Difference

between class and structure

UNIT - 2

Defining Classes in C++, accessing class members, access specifiers (Public and Private), defining member functions, static data members, static member functions, friend functions, friend classes, inline functions, nested classes, passing objects to functions, returning objects, object assignment, Array of objects, Constructor and Destructors

UNIT - 3

Base-class access control, access specifier (Protected), scope rules, Inheriting Multiple Base classes, constructors, destructors &inheritance passing parameters to base class constructors. Virtual base class. String class-Usage of standard library string class with example programs.

UNIT - 4

Polymorphism, Pointers: Pointers to objects, „this" Pointer, Pointers to derived types.

Operator Overloading: Overloading Unary Operators, and Overloading Binary Operators using friend functions, Function Overloading, Virtual functions: Pure Virtual Functions, Abstract classes Templates: Introduction, simple generic classes & generic function, simple example programs. STL-List, Vector, Array

UNIT - 5

Files and Exception Handling: Exception Handling: Fundamentals, exception handling options.

C++ I/O Systems Basics: C++ Streams, C++ Stream classes, Unformatted I/O Operations, Formatted I/O Operations, Formatting using Manipulators. C++ File I/O: Introduction, Classes for file stream Operations, Opening and closing a file, detecting end-of file

TEXT/REFERENCE BOOKS

1. Herbert Schildt, The Complete Reference C++, Fourth Edition, TMH Publications.
2. Deitel& Deitel, C++ How to Program, Pearson Education, 3rd Edition
3. E.Balaguruswamy, Object Oriented Programming with C++, TMH Publications,3rd Edition.