JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

(Established by Govt. of A.P., ACT No.30 of 2008)

ANANTHAPURAMU – 515 002 (A.P) INDIA

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B. Tech (Regular-Full Time)

(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

ELECTRONICS ENGINEERING (VLSI DESIGN AND TECHNOLOGY)

III & IV YEAR COURSE STRUCTURE

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SYLLABUS

III B.Tech I Semester(EE (VLSI Design and Technology))

S.No.	Course code	Title	L	T	P	Credits
1	23A41501	Digital IC Applications	3	0	0	3
2	23A41502	Analog IC Applications	3	0	0	3
3	23A04503T	Micro Processors and Microcontrollers	3	0	0	3
4	23A05504	Introduction To Quantum Technologies And Applications	3	0	0	3
5	23A04504a 23A04504b 23A41503	**Professional Elective-I** 1. Computer Architecture & Organization 2. Information Theory and Coding 3. Introduction to Micro fabrication	3	0	0	3
6		**Open Elective-I**	3	0	0	3
7	23A04501P	Analog & Digital IC Applications Lab	0	0	3	1.5
8	23A04503P	Micro Processors and Microcontrollers Lab	0	0	3	1.5
9	23A04506	**Skill Enhancement course** PCB Design and Prototype development	0	1	2	2
10	23A03508	Tinkering Lab	0	0	2	1
	23A41504	Evaluation of Community Service Internship	-	-	-	2
Total			**18**	**1**	**10**	**26**

Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1	23A01505a	Green Buildings	CIVIL
2	23A01505b	Construction Technology and Management	
3	23A02505	Electrical Safety Practices and Standards	EEE
4	23A03505	Sustainable Energy Technologies	ME
5	23A05506a	Java Programming	CSE & Allied/IT
6	23A05506b	Fundamentals of Artificial Intelligence	
7	23A05506c	Quantum Technologies and Applications	
8	23A54501	Mathematics for Machine Learning and AI	Mathematics
9	23A56501	Materials Characterization Techniques	Physics
10	23A51501	Chemistry of Energy Systems	Chemistry
11	23A52502a	English for Competitive Examinations	Humanities
12	23A52502b	Entrepreneurship and New Venture Creation	

Note:

1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.

2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.

3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline.

III B.Tech II Semester (EE (VLSI Design and Technology))

S.No.	Course code	Title	L	T	P	Credits
1	23A04601	Digital Signal Processing	3	0	0	3
2	23A04602T	Microwave and Optical Communications	3	0	0	3
3	23A04603T	VLSI Design	3	0	0	3
4	23A41601 23A04604a 23A04604b	**Professional Elective-II** 1. Scripting Languages for VLSI 2. Electronic Measurements and Instrumentation 3. Embedded systems & IOT	3	0	0	3
5	23A41602 23A04605b 23A04605c	**Professional Elective-III** 1. Testing of VLSI Circuits 2. Artificial Intelligence & Machine learning 3. Satellite Communications	3	0	0	3
6		**Open Elective-II**	3	0	0	3
7	23A04602P	Microwave and Optical Communications Lab	0	0	3	1.5
8	23A04603P	VLSI Design Lab	0	0	3	1.5
9	23A04607	**Skill Enhancement course** Machine Learning and DSP	0	1	2	2
10	23A52601	Technical Paper Writing &IPR	2	0	0	-
Total			**20**	**1**	**08**	**23**
Mandatory Industry Internship of 08 weeks duration during summer vacation						

Open Elective – II

S.No.	Course Code	Course Name	Offered by the Dept.
1	23A01606a	Disaster Management	CIVIL
2	23A01606b	Sustainability In Engineering Practices	
3	23A02605	Renewable Energy Sources	EEE
4	23A03606	Automation and Robotics	ME
5	23A32502T	Operating Systems	CSE& Allied/IT
6	23A32501T	Introduction to Machine Learning	
7	23A54601a	Optimization Techniques for Engineers	Mathematics
8	23A54601b	Mathematical Foundation Of Quantum Technologies	
9	23A56601	Physics Of Electronic Materials And Devices	Physics
10	23A51601	Chemistry Of Polymers And Applications	Chemistry
11	23A52602	Academic Writing and Public Speaking	Humanities

IV B.Tech I Semester (EE (VLSI Design and Technology))

S.No.	Course code	Title	L	T	P	Credits
1	23A41701	FPGA Architectures and ASICs	3	0	0	3
2	23A52701a 23A52701b 23A52701c	**Management Course-II** 1.Business Ethics and Corporate Governance 2.E-Business 3.Management Science	2	0	0	2
3	23A04703a 23A04702b 23A04702c	**Professional Elective-IV** 1. Low Power VLSI Design 2. DSP Processors & Architectures 3. Cellular & Mobile Communications	3	0	0	3
4	23A41702a 23A04605a 23A41702b	**Professional Elective-V** 1. VLSI Physical Design 2. Digital Image Processing 3. Digital Design with Verilog	3	0	0	3
5		**Open Elective-III**	3	0	0	3
6		**Open Elective-IV**	3	0	0	3
7	23A04705a 23A04705b	**Skill Enhancement course** 1.RF System Design tools 2.Industrial IOT & Automation (SEC – V)	0	1	2	2
8	23A52702	**Audit Course** Gender Sensitization	2	0	0	-
9	23A41703	Evaluation of Industry Internship	-	-	-	2
Total			**19**	**1**	**02**	**21**

Open Elective – III

S.No	Course Code	Course Name	Offered by the Dept.
1	23A01704a	Building Materials and Services	CIVIL
2	23A01704b	Environmental Impact Assessment	
3	23A02704	Smart Grid Technologies	EEE
4	23A03704	3D Printing Technologies	ME
5	23A05402T	Data Base Management Systems	CSE & Allied/IT
6	23A38502	Cyber Security	
7	23A54701	Wavelet transforms and its Applications	Mathematics
8	23A56701a	Smart Materials And Devices	Physics
9	23A56701b	Introduction to Quantum Mechanics	
10	23A51701	Green Chemistry And Catalysis For Sustainable Environment	Chemistry
11	23A52703	Employability Skills	Humanities

Open Elective – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	23A01705a	Geo-Spatial Technologies	CIVIL
2	23A01705b	Solid Waste Management	
3	23A02705	Electric Vehicles	EEE
4	23A03705	Total Quality Management	ME
5	23A05502T	Introduction to Computer Networks	CSE & Allied/IT
6	23A35501T	Internet of Things	
7	23A32603	Introduction to Quantum Computing	
8	23A54702	Financial Mathematics	Mathematics
9	23A56702	Sensors And Actuators For Engineering Applications	Physics
10	23A51702	Chemistry Of Nanomaterials And Applications	Chemistry
11	23A52704	Literary Vibes	Humanities

IV B.Tech. II Semester (EE (VLSI Design and Technology))

S.No.	Course code	Title	Category	L	T	P	Credits
1	23A41801	Internship		-	-	-	4
		Project					8
Total							**12**

COURSES OFFERED FOR HONOURS DEGREE WITH VLSI SPECIALIZATION IN ELECTRONICS AND COMMUNICATION ENGINEERING

S. No.	Course Code	Title	L	T	P	Credits
1	23A04H01	Analog IC Design.	3	0	0	3
2	23A04H02	Digital IC Design	3	0	0	3
3	23A04H03	Low power VLSI	3	0	0	3
4	23A04H04	Testing and Verification	3	0	0	3
5	23A04H05	FPGA architectures	3	0	0	3
6	23A04H06	Analog and Digital IC Design Lab	0	0	3	1.5
7	23A04H07	Physical Design Automation Lab	0	0	3	1.5
Total			**15**	**0**	**06**	**18**

LIST OF MINORS OFFERED TO Electronics Engineering (VLSI Design and Technology)

S.No.	Minor Title	Department offering the Minor
1	Building Planning & Construction Technology	Civil
2	Micro Grid Technology	EEE
3	Energy Systems	
4	3D Printing	ME
5	Industrial Engineering	
6	Computer Science and Engineering	CSE & Allied
7	Cyber Security	
8	Internet of Things	
9	Data Science	
10	Artificial Intelligence & Machine Learning	
11	Data Analytics	
12	Data Science and Analytics	
13	Programming & Computational Intelligence	
14	AI Applications & Emerging Technologies	
15	Quantum Computing	
16	Quantum Technologies	

III B.Tech I Sem

23A41501	**DIGITAL IC APPLICATIONS**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the characteristics and applications of CMOS, TTL, and other logic families.
2. To learn writing VHDL code for structural and data flow modeling of digital circuits.
3. To Understand and apply different delay models in VHDL to accurately simulate circuit behavior.
4. To model combinational logic circuits in VHDL, including adders, multiplexers, and ALUs.
5. To implement sequential logic designs, such as counters, registers, and state machines, in VHDL.

Course Outcomes:

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

1. Understand the characteristics and applications of CMOS, TTL, and other logic families.
2. Learn writing VHDL code for structural and data flow modeling of digital circuits.
3. Apply different delay models in VHDL to accurately simulate circuit behavior.
4. Model combinational logic circuits in VHDL, including adders, multiplexers, and ALUs.
5. Implement sequential logic designs, such as counters, registers, and state machines, in VHDL

UNIT-I

Digital Logic Families and Interfacing: Introduction to logic families, CMOS logic, CMOS steady state and dynamic electrical behavior, CMOS logic families. Bipolar logic, transistor-transistor logic, TTL families, CMOS/TTL interfacing, low voltage CMOS logic and interfacing, Emitter coupled logic.

UNIT-II

Introduction to VHDL: Design flow, program structure, levels of abstraction, Elements of VHDL: Data types, data objects, operators and identifiers. Packages, Libraries and Bindings, Subprograms. VHDL Programming using structural and data flow modeling.

UNIT-III

Behavioral Modeling: Process statement, variable assignment statement, signal assignment statement, wait statement, if statement, case statement, null statement, loop statement, exit

statement, next statement, assertion statement, more on signal assignment statement, Inertial Delay Model, Transport Delay Model, Creating Signal Waveforms, Signal Drivers, Other Sequential Statements, Multiple Processes. Logic Synthesis, Inside a logic Synthesizer.

UNIT-IV

Combinational Logic Design: Binary Adder-Subtractor, Ripple Adder, Look Ahead Carry Generator, ALU, Decoders, encoders, multiplexers and demultiplexers, parity circuits, comparators, Barrel Shifter, Simple Floating Point Encoder, Dual Priority Encoder, Design considerations of the above combinational logic circuits with relevant Digital ICs, modeling of above ICs using VHDL.

UNIT-V

Sequential Logic Design: SSI Latches and flip flops, Ring Counter, Johnson Counter, Design of Modulus N Synchronous Counters, Shift Registers, Universal Shift Registers, Design considerations of the above sequential logic circuits with relevant Digital ICs, modeling of above ICs using VHDL.

Text book:

1. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Ed., 2005.

2. VHDL Primer – J. Bhasker, Pearson Education/ PHI, 3rd Edition.

References:

1. Fundamentals of Digital Logic with VHDL Design- Stephen Brown, ZvonkoVranesic, McGrawHill, 3rd Edition.

III B.Tech I Sem

23A41502	**ANALOG INTEGRATED CIRCUITS APPLICATIONS**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the fundamental characteristics and configurations of operational amplifiers.
2. To design and analyze various Op-Amp-based linear and nonlinear circuits.
3. To develop waveform generation and timing circuits using Op-Amps, 555 timers, and Phase-Locked Loops (PLLs).
4. To design active filters and voltage regulator circuits using Op-Amps.
5. To implement DAC and ADC circuits for required applications.

Course Outcomes:

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

1. Understand the fundamental characteristics and configurations of operational amplifiers.
2. Design and analyze various Op-Amp-based linear and nonlinear circuits.
3. Develop waveform generation and timing circuits using Op-Amps, 555 timers, and Phase-Locked Loops (PLLs).
4. Design active filters and voltage regulator circuits using Op-Amps.
5. Implement DAC and ADC circuits for required applications.

UNIT-I:

Operational Amplifier Characteristics: Op-amp symbol, terminals, packages and specifications – Block diagram Representation of op-amp- Ideal op-amp & practical op-amp – Open loop & closed loop configurations – DC & AC performance characteristics of op-amp – Frequency compensation, Differential amplifiers – General Description.

UNIT-II:

Op–Amp Applications: Basic op-amp circuits: Inverting & Non-inverting voltage amplifiers - Voltage follower - Summing, scaling & averaging amplifiers.

Linear Applications: Instrumentation Amplifiers-V-to-I & I-to-V Converters-Differentiators & Integrators.

Non-linear Applications: Precision Rectifiers – Wave Shaping Circuits (Clipper and Clampers) – Log and Antilog Amplifiers – Analog voltage multiplier circuit, Comparators, Sample and Hold circuit.

UNIT-III:

Waveform Generators and PLL : Waveform Generators: Sine-wave Generators – Square / Triangle / Saw-tooth Wave generators.
IC 555 Timer: Monostable and A stable operation and its applications.
PLL: Operation of basic PLL-Closed loop analysis of PLL-Voltage Controlled Oscillator.

UNIT-IV:

Active Filters & Voltage Regulator: Filters: Comparison between Passive and Active Networks, Design of LPF, HPF, BPF and Band Reject and All Pass Filters
Voltage Regulators: Basics of Voltage Regulator – Linear Voltage Regulators using Op-amp – IC Regulators (78xx, 79xx, LM 317, LM 337, 723)-Switching Regulators.

UNIT-V:

Data Conversion Devices: Digital- to-Analog Conversion: DAC Specifications – DAC-Weighted Resistor, DAC-R-2R Ladder and DAC-Inverted R-2R Ladder.
Analog-to-Digital conversion: ADC specifications-ADC circuits-Ramp Type ADC-Successive Approximation ADC-Dual Slope ADC-Flash Type ADC.

Text books:

1. Roy Choudhury and Shail Jain, "Linear Integrated Circuits", 2nd Edition, New Age International Publishers, 2003.
2. S.Salivahanan and V.S. KanchanaBhaaskaran, "Linear Integrated Circuits", 6th Edition, Tata McGraw-Hill, 2011.
3. RamakantA.Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Edition, Prentice Hall, 2000.

References:

1. Robert F. Coughlin, Frederick F. Driscoll, "Operational-Amplifiers and Linear Integrated Circuits", 6th Edition, Prentice Hall, 2001.
2. Sergio Franco, "Design with operational amplifier and analog integrated circuits", McGraw Hill, 1997

III B.Tech I Sem

23A04503T	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn the fundamental architectural concepts of microprocessors.
2. To gain knowledge about assembly language programming concepts.
3. To get familiar about 8086 interfacing.
4. To understand the fundamentals of the 8051 Microcontroller.
5. To learn interfacing with the 8051 Microcontroller.

Course Outcomes:

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

1. Learn the fundamental architectural concepts of microprocessors.
2. Gain knowledge about assembly language programming concepts.
3. Understand the concepts of 8086 interfacing.
4. Learn the fundamentals of the 8051 Microcontroller.
5. Know the interfacing with the 8051 Microcontroller.

UNIT I

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT II

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT IV

Microcontroller : Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V

Interfacing Microcontroller :- Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rdEdition,1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

III B.Tech I Sem

23A05504	INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATIONS (Qualitative Treatment)	L	T	P	C
		3	0	0	3

Course Objectives (COBJ):

- Introduce fundamental quantum concepts like superposition and entanglement.
- Understand theoretical structure of qubits and quantum information.
- Explore conceptual challenges in building quantum computers.
- Explain principles of quantum communication and computing.
- Examine real-world applications and the future of quantum technologies.

Course Outcomes (CO):

- Explain core quantum principles in a non-mathematical manner.
- Compare classical and quantum information systems.
- Identify theoretical issues in building quantum computers.
- Discuss quantum communication and computing concepts.
- Recognize applications, industry trends, and career paths in quantum technology.

Unit 1: Introduction to Quantum Theory and Technologies

The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison,Quantum states and measurement: nature of observation,Overview of quantum systems: electrons, photons, atoms,The concept of quantization: discrete energy levels,Why quantum? Strategic, scientific, and technological significance,A snapshot of quantum technologies: Computing, Communication, and Sensing,National and global quantum missions: India's Quantum Mission, EU, USA, China

Unit 2: Theoretical Structure of Quantum Information Systems

What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view),Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract,The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences,Philosophical implications: randomness, determinism, and observer role

Unit 3: Building a Quantum Computer – Theoretical Challenges and Requirements

What is required to build a quantum computer (conceptual overview)?,Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers:

Why maintaining entanglement is difficult,Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison),Superconducting circuits, Trapped ions, Photonics, Visionvs reality: what's working and what remains elusive,The role of quantum software in managing theoretical complexities

Unit 4: Quantum Communication and Computing – Theoretical Perspective

Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD),Role of Entanglement in Communication,The Idea of the Quantum Internet – Secure Global Networking,Introduction to Quantum Computing,Quantum Parallelism (Many States at Once),Classical vs Quantum Gates, Challenges: Decoherence and Error Correction,Real-World Importance and Future Potential

Unit 5: Applications, Use Cases, and the Quantum Future

Real-world application domains: Healthcare (drug discovery),Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum,Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization,Emerging careers in quantum: roles, skillsets, and preparation pathways,Educational and research landscape – India's opportunity in the global quantum race

Textbooks:

1. Michael A. Nielsen, Isaac L. Chuang, ***Quantum Computation and Quantum Information***, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, ***Quantum Computing: A Gentle Introduction***, MIT Press, 2011.
3. Chris Bernhardt, ***Quantum Computing for Everyone***, MIT Press, 2019.

Reference Books:

1. David McMahon, ***Quantum Computing Explained***, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, ***An Introduction to Quantum Computing***, Oxford University Press, 2007.
3. Scott Aaronson, ***Quantum Computing Since Democritus***, Cambridge University Press, 2013.
4. **Alastair I.M. Rae**, ***Quantum Physics: A Beginner's Guide***, Oneworld Publications, Revised Edition, 2005.
5. **Eleanor G. Rieffel, Wolfgang H. Polak**, ***Quantum Computing: A Gentle Introduction***, MIT Press, 2011.
6. **Leonard Susskind, Art Friedman**, ***Quantum Mechanics: The Theoretical Minimum***, Basic Books, 2014.
7. **Bruce Rosenblum, Fred Kuttner**, ***Quantum Enigma: Physics Encounters Consciousness***, Oxford University Press, 2nd Edition, 2011.
8. **GiulianoBenenti, GiulioCasati, GiulianoStrini**, ***Principles of Quantum Computation and Information, Volume I: Basic Concepts***, World Scientific Publishing, 2004.
9. **K.B. Whaley et al.**, ***Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document***, Quantum Flagship, European Commission, 2020.
10. **Department of Science & Technology (DST), Government of India**, ***National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers***, MeitY/DST Publications, 2020 onward.

Online Learning Resources:

- IBM Quantum Experience and Qiskit Tutorials
- Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
- edX – The Quantum Internet and Quantum Computers
- YouTube – Quantum Computing for the Determined by Michael Nielsen
- Qiskit Textbook – IBM Quantum

III B.Tech I Sem

23A04504a	**COMPUTER ARCHITECTURE & ORGANIZATION (Professional Elective I)**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To learn the design of various functional units of digital computersand performance issues of computer systems.
2. To understand the basic processing unit and their connections.
3. To get familiar with different types of Data representation and Computer Arithmetic operations.
4. To know about different types of memory and their interconnections.
5. To learn the basics of parallel computing and pipelining.

Course Outcomes:

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

1. Learn the design of various functional units of digital computersand performance issues of computer systems.
2. Understand the basic processing unit and their connections.
3. Know about different types of Data representation and Computer Arithmetic operations.
4. Learn about different types of memory and their interconnections.
5. Understand the basics of parallel computing and pipelining.

UNIT I

Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.

Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

UNIT II

Micro programmed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

UNIT III

Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation.

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

UNIT IV

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer,Priority Interrupt Direct memory Access.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory,Cache Memory.

UNIT V

Reduced Instruction Set Computer: CISC Characteristics, RISC Characteristics. Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline, Vector Processing, Array Processor. Multi Processors: Characteristics of Multiprocessors, Interconnection Structures, Inter-processor arbitration, Inter-processor communication and synchronization, Cache Coherence.

Textbook:

1. Computer System Architecture – M. Moris Mano, Third Edition, Pearson/PHI.

References:

1. Computer Organization – Car Hamacher, ZvonksVranesic, SafeaZaky, Vth Edition, McGraw Hill.
2. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
3. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.

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III B.Tech I Sem

23A04504b	**INFORMATION THEORY AND CODING**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To provide an insight into the concept of information in the context of communication theory and communication receivers.
2. To implement various source coding algorithms and analyze their performance.
3. To gain knowledge about techniques for error detection and error correction.
4. To design linear block codes and cyclic codes.
5. To get familiar with various convolutional codes.

Course Outcomes:

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

1. Learn the concepts of information in the context of communication theory and communication receivers.
2. Implement various source coding algorithms and analyze their performance.
3. Gain knowledge about techniques for error detection and error correction.
4. Design linear block codes and cyclic codes.
5. Understand various convolutional codes.

UNIT I

Information Theory: Introduction, Definition of Entropy, Conditional Entropy, Relative Entropy, Basic Properties of Entropy, Mutual Information, Information Inequalities, Problem solving.

Block to Variable length Coding: Prefix-free Code, Coding a single Random Variable, Prefix, Free Code, Kraft Inequality, Bounds on optimal Code length, Coding a Single Random Variable, Rooted Tree with Probabilities, Shanon-Fano Coding, Free fix code, Coding an information Source, Huffman Coding, Example.

Variable to Block Length Coding: Proper message set, Assigning probabilities to K-ary rooted tree corresponding to a proper message set, Prefix free Coding of a proper message set, Tunstall message set, Tunstall coding.

UNIT II

Asymptotic Equi-partition Property, Chebyshev inequality, Weak law of large numbers, Typical Sequences, Block to Block Coding of DMS: Consequences of Asymptotic Equipartition Property, Problem solving.

Universal Source Coding: Lempel-Ziv Algorithm, LZ -77 Encoding and Decoding, Lempel-Ziv Welch (LZW) Algorithm, LZW Encoding, and Decoding.

Coding of Sources with memory, Channel Capacity, Noisy Channel Coding Theorem, Differential Entropy, Gaussian Channel, Rate Distortion Theory, Blahut-Arimoto Algorithm, problem solving.

UNIT III

Error Control Coding: Introduction to Error Control Codes, Error Probability with Repetition in the Binary Symmetric Channel, Parity Check Bit Coding for Error Detection, Block Coding for Error Detection and Correction, The Hamming Distance, The upper bound of the Probability of Error with Coding, Soft Decision Decoding, Hard Decision Decoding.

UNIT IV

Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Encoding Block Codes, Decoding of Block Codes, Single Parity Check bit Code, Repeated Codes, Hadamard Code, Hamming Code, Cyclic Codes, Generator and Parity-Check Matrices of Cyclic Codes, Encoding and Decoding of Cyclic Codes, BCH codes, Reed-Solomon Code.

UNIT V

Convolutional Coding, Code Generation, Decoding Convolutional Code, the Code Tree, Decoding in the presence of Noise, State and Trellis Diagrams, The Viterbi Algorithm, Comparison of Error Rates in Coded and Uncoded Transmission, Turbo Codes, LDPC codes, Hard and Soft Decision Decoding.

Textbooks:

1. Thomas M.Cover, Joy A. Thomas, Elements of Information Theory, John Wiley & Sons,2nd Edition, 2006.
2. Herbert Taub, Donald L Shilling, GoutamSaha, Principles of Communication Systems, 4th Edition, McGraw Hill, 2017.

References:

1. Shu Lin, Daniel J. Costello Jr., Error Control Coding, Pearson, Second Edition, 2013.
2. Simon Haykin, Communication Systems, John Wiley, 4th Edition, 2010.

III B.Tech I Sem

23A41503	**INTRODUCTION TO MICRO FABRICATION**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the history and evolution of integrated circuits (ICs)and the characteristics of materials.
2. To analyze the processes involved in wafer cleaning, oxidation, and lithography**.**
3. To learn the fundamentals of diffusion and ion implantationin IC fabrication.
4. To explore thin-film deposition techniquesin VLSI fabrication.
5. To study the etching processand the differences between wet and plasma etching techniques.

Course Outcomes:

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

1. Understand the history and evolution of integrated circuits (ICs)and the characteristics of materials.
2. Analyze the processes involved in wafer cleaning, oxidation, and lithography**.**
3. Learn the fundamentals of diffusion and ion implantationin IC fabrication.
4. Explore thin-film deposition techniquesin VLSI fabrication.
5. Know about the etching processand the differences between wet and plasma etching techniques.

Unit-1

Introduction: 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

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

Diffusion: 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

Thin Film Deposition: 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 .

Unit-5

Etching: 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, Electromigration, Metal Silicides, Multi-Level Metallization, Planarization, Inter Metal Dielectric

Text 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

Reference Books

1. Silicon Process Technology, S K Gandhi,2nd Edition, Wiley India,2009.

III B.Tech I Sem(EE (VLSI Design and Technology))

		L	T	P	C
23A04501P	**ANALOG & DIGITAL IC APPLICATIONS LABORATORY**	0	0	3	1.5

Course Objectives:

1. To design and implement circuits such as filters, function generators, and voltage regulators using operational amplifiers and other analog ICs.
2. To develop the skills to write and simulate VHDL/Verilog code for modeling basic digital components.
3. To gain hands-on experience in designing and simulating sequential circuits

Course Outcomes:

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

1. Design and implement circuits such as filters, function generators, and voltage regulators using operational amplifiers and other analog ICs.
2. Develop the skills to write and simulate VHDL/Verilog code for modeling basic digital components.
3. Gain hands-on experience in designing and simulating sequential circuits

Minimum TEN Experiments to be conducted: (Five from each group)

Part A

1. OPAMP Applications–Adder, Subtractor, Comparator Circuits.
2. Active Filter Applications–LPF,HPF(first order).
3. Function Generator using OPAMPs.
4. IC555Timer–Monostable and Astable Operation Circuit.
5. IC566–VCO Applications.
6. Voltage Regulator using IC 723.
7. 4bit DAC using OPAMP.

PartB

Simulate the internal structure of the following Digital IC's using VHDL / VERILOG

1. **Logic Gates** : Simulate and model basic logic gates (AND, OR, NOT, etc.) using VHDL/Verilog.
2. **Half Adder, Half Subtractor, Full Adder, Full Subtractor .**Design and simulate

basic arithmetic circuits such as adders and subtractors in VHDL/Verilog.

3. **Ripple Carry Adder.**Design and simulate basic arithmetic circuits such as adders and subtractors in VHDL/Verilog.
4. **3-8 Decoder and 8-3 Encoder**: Simulate the working of a 3-to-8 decoder and an 8-to-3 encoder, commonly used in memory addressing and communication systems.
5. **8x1 Multiplexer and 2x4 Demultiplexer**: Design and simulate multiplexers and demultiplexers, essential for selecting multiple data sources and routing outputs.
6. **4-Bit Comparator**: Model and simulate a 4-bit comparator for comparing two 4-bit inputs and determining the result (greater than, less than, equal to).
7. **D Flip-Flop**: Simulate the internal structure and operation of a D flip-flop, a fundamental building block in sequential logic circuits.
8. **JK Flip-Flop**: Design and simulate the JK flip-flop, which provides more flexibility than the D flip-flop for sequential logic operations.
9. **Decade Counter**: Model and simulate a decade counter for counting in decimal sequences, which is widely used in timing and clock generation.
10. **Universal Shift Register**: Design and simulate a universal shift register that can perform shifting, loading, and storing operations, often used in data storage and transfer systems.

III B.Tech I SemEE (VLSI Design and Technology))

		L	T	P	C
23A04503P	**MICROPROCESSORS AND MICRO CONTROLLERS LAB**	0	0	3	1.5

Course Objectives:

1. To become skilled in 8086 Assembly Language programming.
2. To understand the detailed software and hardware structure of the microprocessor.
3. Train their practical knowledge through laboratory experiments.
4. To understand and learn 8051 Microcontroller.
5. To acquire knowledge on microprocessors and microcontrollers, interfacing various peripherals, and configuring.

Course Outcomes:

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

1. Formulate a program and implement algorithms using Assembly language.
2. Describe an Assembly language program for the 8086 Microprocessor.
3. Develop programs for different applications in the 8086 Microprocessor.
4. Interface peripheral devices with 8086 and 8051.
5. Use an Assembly/Embedded C programming approach for solving real-world problems.

List of Experiments: (Any TEN of the experiments are to be conducted)

1. **Programs for 16 Bit Arithmetic Operations** (Using various addressing modes)
   - **a)** Write an ALP to Perform Addition and Subtraction of Multi precision numbers.
   - **b)** Write an ALP to Perform Multiplication and division of signed and unsigned Hexadecimal numbers.
   - **c)** Write an ALP to find square, cube and factorial of a given number.
2. **Programs Involving Bit Manipulation Instructions**
   - **a)** Write an ALP to find the given data is positive or negative.
   - **b)** Write an ALP to find the given data is odd or even.
   - **c)** Write an ALP to find Logical ones and zeros in a given data.
3. **Programs on Arrays for 8086**
   - **a)** Write an ALP to find Addition/subtraction of N no‘s.
   - **b)** Write an ALP for finding largest/smallest no.
   - **c)** Write an ALP to sort given array in Ascending/descending order.
4. **Programs on String Manipulations for 8086**
   - **a)** Write an ALP to find String length.
   - **b)** Write an ALP for Displaying the given String.
   - **c)** Write an ALP for Comparing two Strings.
   - **d)** Write an ALP to reverse String and Checking for palindrome.
5. **Programs for Digital Clock Design Using 8086**
   - **a)** Write an ALP for Designing clock using INT 21H Interrupt.
   - **b)** Write an ALP for Designing clock using DOS Interrupt Functions.
   - **c)** Write an ALP for Designing clock by reading system time.

6. **Interfacing Stepper Motor with 8086**
   a) Write an ALP to 8086 processor to Interface a stepper motor and operate it in clockwise by choosingvariable step-size.
   b) Write an ALP to 8086 processor to Interface a stepper motor and operate it in Anti-clockwise bychoosing variable step-size.
7. **Interfacing ADC/DAC with 8086**
   a) Write an ALP to 8086 processor to Interface ADC.
   b) Write an ALP to 8086 processor to Interface DAC and generate Square Wave/Triangular Wave/Stepsignal.
8. **Communication between Two Microprocessors**
   a) Write an ALP to have Parallel communication between two microprocessors using 8255
   b) Write an ALP to have Serial communication between two microprocessor kits using 8251.
9. **Programs using Arithmetic and Logical Instructions for 8051**
   a) Write an ALP to 8051 Microcontroller to perform Arithmetic operations like addition, subtraction,
   b) Multiplication and Division.
   c) Write an ALP to 8051 Microcontroller to perform Logical operations like AND, OR and XOR.
   d) Programs related to Register Banks.
10. **Programs to Verify Timers/Counters of 8051**
    a) Write a program to create a delay of 25msec using Timer0 in mode 1 and blink all the Pins of P0.
    b) Write a program to create a delay of 50 µsec using Timer1 in mode 0 and blink all the Pins of P2.
    c) Write a program to create a delay of 75msec using counter0 in mode 2 and blink all the Pins of P1.
    d) Write a program to create a delay of 80 µsec using counter1 in mode 1 and blink all the Pins of P3.
11. **UART Operation in 8051**
    a) Write a program to transfer a character serially with a baud rate of 9600 using UART.
    b) Write a program to transfer a character serially with a baud rate of 4800 using UART.
    c) Write a program to transfer a character serially with a baud rate of 2400 using UART.
12. **Interfacing LCD with 8051**
    a) Develop and execute the program to interface16*2 LCD to 8051.
    b) Develop and execute the program to interface LCD to 8051 in 4-bit or 8-bit mode.

Reference Books:

1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning,2010.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition2006.
3. The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad AliMazidi, Janice GillispieMazidi, Second Edition.

III B.Tech I Sem(EE (VLSI Design and Technology))

23A04506	**PCB DESIGN AND PROTOTYPE DEVELOPMENT (SEC – III)**	**L**	**T**	**P**	**C**
		0	1	2	2

Course Objectives:

1. Identifying Electronic Components Symbols & Footprints.
2. To analyse the capability to produce PCBs of their circuit.
3. To effectively use the design rules & interfacing between schematic & PCB.

Course Outcomes:

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

1. Students can design a schematic of their circuit.
2. Students can design PCB layout of their design.
3. Detailed description and practical of PCB designing.

UNIT I

Fundamental of basic electronics: Component identification, Component symbols & their footprints, understand schematic, Creating new PCB, Browsing footprints libraries, Setting up the PCB layers, Design rule checking, Track width selection, Component selection, Routing and completion of the design

UNIT II

Introduction to PCB: Definition and Need/Relevance of PCB, Background and History of PCB, Types of PCB, Classes of PCB Design, Terminology in PCB Design, Different Electronic design automation (EDA)tools and comparison.

UNIT III

PCB Design Process: PCB Design Flow, Placement and routing, Steps involved in layout design, Artwork generation Methods - manual and CAD, General design factors for digital and analogue circuits, Layout and Artwork making for Single-side, double-side and Multilayer Boards, Design for manufacturability, Design-specification standards

Practice Exercises: Any twelve experiments are to be done

1. Practice following PCB Design steps

- SchematicDesign:FamiliarizationoftheSchematicEditor,Schematiccreation,Annotation, Netlist generation.
- LayoutDesign:FamiliarizationofFootprintEditor,Mappingofcomponents,Creationof PCB layout Schematic.
- Create new schematic components.
- Create new component footprints.

2. Regulator circuit using 7805
3. InvertingAmplifier or SummingAmplifier using op-amp
4. Full-wave Rectifier
5. Astablemultivibrator using IC555
6. Monostablemultivibrator using IC555
7. RCPhase-shiftOscillatorusingtransistor.
8. Wein-bridgeOscillatorusing op-amp.
9. Full-Adder using half-adders.
10. 4-bit binary /MOD N counter using D-Flip flops.
11. One open-ended (analog/ digital/mixed circuit) experiments of similar nature andmagnitude to the above are to be assigned by the teacher

    (Student is expected to solve and execute/simulate independently).
12. Design an 8051 Development board having Power section consisting of IC7805, capacitor, resistor, headers, LED.
13. Design an 8051 Development board having Serial communication section consisting of MAX 232, Capacitors, DB9connector,Jumper, LEDs
14. Design an 8051 Development board having Reset&Input/outputsectionsconsistingof89C51Microcontroller,ElectrolyticCapacitor,Resistor,Jumper,CrystalOscillator,Capacitors
15. Fabricate a single-sided PCB, mount the components and assemble them in acabinet for any one of the circuits mentioned in the above exercises.

References:

1. Jon Varteresian, Fabricating Printed Circuit Boards, z, 2002
2. R. Tummala, Fundamentals of Microsystems Packaging, McGraw-Hill 2001
3. C. Robertson. PCB Designer´s Reference. Prentice Hall, 2003
4. Open-source EDA Tool KiCad Tutorial: http://kicad-pcb.org/help/tutorials/ 13. PCB Fabrication user guide page:

   http://www.wikihow.com/Create-Printed-Circuit-Boards

   http://www.siongboon.com/projects/2005-09-07_home_pcb_fabrication/

   http://reprap.org/wiki/MakePCBInstructions#Making_PCBs_yourself

   PCB Fabrication at home(video): https://www.youtube.com/watch?v=mv7Y0A9YeUc, https://www.youtube.com/watch?v=imQTCW1yWkg

III B.Tech – I semester

		L	T	P	C
23A03508	**TINKERING LAB**	2	0	0	1

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

	Course objectives: The objectives of the course are to
1	**Encourage Innovation and Creativity**
2	**Provide Hands-on Learning and Impart Skill Development**
3	**Foster Collaboration and Teamwork**
4	**Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship**
5	**Impart Problem-Solving mind-set**

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

List of experiments:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Design and 3D print a Walking Robot
3) Design and 3D Print a Rocket.
4) Temperature & Humidity Monitoring System (DHT11 + LCD)
5) Water Level Detection and Alert System
6) Automatic Plant Watering System
7) Bluetooth-Based Door Lock System
8) Smart Dustbin Using Ultrasonic Sensor
9) Fire Detection and Alarm System
10) RFID-Based Attendance System
11) Voice-Controlled Devices via Google Assistant
12) Heart Rate Monitoring Using Pulse Sensor
13) Soil Moisture-Based Irrigation
14) Smart Helmet for Accident Detection
15) Milk Adulteration Detection System
16) Water Purification via Activated Carbon
17) Solar Dehydrator for Food Drying
18) Temperature-Controlled Chemical Reactor
19) Ethanol Mini-Plant Using Biomass
20) Smart Fluid Flow Control (Solenoid + pH Sensor)

21) Portable Water Quality Tester
22) AI Crop Disease Detection
23) AI-based Smart Irrigation
24) ECG Signal Acquisition and Plotting
25) AI-Powered Traffic Flow Prediction
26) Smart Grid Simulation with Load Monitoring
27) Smart Campus Indoor Navigator
28) Weather Station Prototype
29) Firefighting Robot with Sensor Guidance
30) Facial Recognition Dustbin
31) Barcode-Based Lab Inventory System
32) Growth Chamber for Plants
33) Biomedical Waste Alert System
34) Soil Classification with AI
35) Smart Railway Gate
36) Smart Bin Locator via GPS and Load Sensors
37) Algae-Based Water Purifier
38) Contactless Attendance via Face Recognition

- **Note:** The students can also design and implement their own ideas, apart from the list of experiments mentioned above.
- **Note:** A minimum of 8 to 10 experiments must be completed by the students.

III B.Tech II Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04601	**DIGITAL SIGNAL PROCESSING**	3	0	0	3

Course Objectives:

1. To get familiar with theproperties of discrete time signals, systems and z-transform.
2. To learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations.
3. To understand the implementations of digital filter structures.
4. To analyse the FIR filter design using Fourier series and windowing methods.
5. To gain the knowledge on Programmable DSP Devices.

Course Outcomes:

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

1. Familiar with the properties of discrete time signals, systems and z-transform.
2. Learn the importance of FFT algorithm for computation of Discrete Fourier Transform and Fast Fourier Transform with decimations.
3. Understand the implementations of digital filter structures.
4. Analyse the FIR filter design using Fourier series and windowing methods.
5. Gain the knowledge on Programmable DSP Devices.

UNIT I

Introduction to discrete time signals and systems: Introduction to digital signal processing,

Review of discrete-time signals and systems, Analysis of discrete-time linear time invariant systems, frequency domain representation of discrete time signals and systems

Z–Transform: Definition, ROC, Properties, Poles and Zeros in Z-plane, the inverse Z-Transform, System analysis, Transfer function, BIBO stability, System Response to standard signals, Solution of difference equations with initial conditions, Illustrative Problems, analysis of linear time-invariant systems in the z-domain, pole-zero stability.

UNIT II

Discrete Fourier Transform : Introduction, Discrete Fourier Series, properties of DFS, Discrete Fourier Transform, Inverse DFT, properties of DFT, Linear and Circular convolution, convolution using DFT, sampling, Quantization effects.

Fast Fourier Transform: Introduction, Fast Fourier Transform, Radix-2 Decimation in time and Decimation in frequency FFT, Inverse FFT (Radix-2).

UNIT III

IIR Filters: Introduction to digital filters, Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital filters from analog filters by Impulse invariant and bilinear transformation methods, Frequency transformations, Basic structures of IIR Filters - Direct form-I, Direct form-II, Cascade form and Parallel form realizations.

UNIT IV

FIR Filters: Introduction, Characteristics of FIR filters with linear phase, Frequency response of linear phase FIR filters, Design of FIR filters using Fourier series and windowing methods (Rectangular, Triangular, Raised Cosine, Hanging, Hamming, Blackman), Comparison of IIR & FIR filters, Basic structures of FIR Filters – Direct form, Cascade form, Linear phase realizations.

UNIT V

Architectures for Programmable DSP Devices: Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.

Textbooks:

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education, 2007.
2. A.V.Oppenheim and R.W. Schaffer, Discrete Time Signal Processing ,PHI.

References:

1. S.K.Mitra, Digital Signal Processing – A practical approach , 2nd Edition, Pearson Education, New Delhi, 2004.
2. MH Hayes, Digital Signal Processing, Schaum's Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.

IIIB.Tech II Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04602T	**MICROWAVE AND OPTICAL COMMUNICATION**	3	0	0	3

Course Objectives:

- To analyse different modes of operation in rectangular wave guides, circular wave guides and resonators.
- To study and analyse various microwave components and microwave sources.
- To gain knowledge on different microwave semiconductor devices and microwave measurements procedures.
- To analyse different optical fiber modes and to study different types of distortions and losses in optical communication.
- To study various optical sources, optical detectors and to analyze various optical links.

Course outcomes.

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

- Aanalyse different modes of operation in rectangular wave guides, circular wave guides and resonators.
- Understand andAanalyse various microwave components and microwave sources.
- Gain knowledge on different microwave semiconductor devices and microwave measurements procedures.
- Aanalyse different optical fibre modes and to study different types of distortions and losses in optical communication.
- Understand study various optical sources, optical detectors and to Aanalyse various optical links.

UNIT I

Waveguides: Introduction, Rectangular waveguides, Field expressions for TE and TM modes, Wave propagation in the guide, Phase and group velocities, Power transmission and attenuation, Waveguide current and mode excitation, Circular waveguide – TE and TM modes(**Qualitative treatment only**), Wave propagation, Cavity resonators (**Qualitative treatment only**).

UNIT II

Passive Microwave Devices: Introduction to scattering parameters and their properties, Terminations, Variable short circuit, Attenuators, Phase shifters, Hybrid Tees (H-plane, E-plane, Magic Tees), Directional Couplers – Bethe hole and Two hole Couplers, Deriving Scattering matrix for Microwave passive devices. Microwave propagation in Ferrites, Gyrator, Isolator, Circulator.

Microwave Amplifiers and Oscillators: Microwave Tubes: Linear Beam Tubes – Two cavity Klystron amplifier -velocity modulation, bunching process, output power, Reflex Klystron

oscillator, power output and efficiency, Travelling Wave Tube (TWT) – Bunching process and amplification process (**Qualitative treatment only**). Crossed Field Tubes – Magnetron oscillator, pi-mode operation, power output and efficiency, Hartree Condition.

UNIT III

Microwave Semiconductor Devices: Gunn Oscillator – Principle of operation, Characteristics, Two valley model, IMPATT, TRAPATT diodes.

Microwave Measurements: Description of Microwave bench-different blocks and their features, errors and precautions, Microwave power measurements, Measurement of attenuation, frequency, VSWR (low, medium, high), Measurement of 'Q' of a cavity, Impedance measurements.

UNIT IV

Introduction to Optical Fibers and Transmission Characteristics: The propagation of light in optical waveguides – Classification of optical fibers – Numerical aperture, Step index and Graded index fiber – Modes in cylindrical fiber – Linearly polarized modes, Attenuation: Absorption, Scattering, Bending losses. Modal dispersion and chromatic dispersion – Single mode fiber - waveguide dispersion– MFD – PMD

UNIT V

Optical Transmitters and Receivers: Optical Sources: - Light source materials – LED homo and hetero structures – surface and edge emitters – Quantum efficiency – Injection Laser Diode – Modes and threshold condition – Structures and Radiation Pattern. Optical detectors: – Physical principles – PIN and APD diodes – Photo detector noise

Optical Link Design: Point- to- point links – System considerations – Link Power budget – Rise time budget.

Textbooks:

1. David M. Pozar," Microwave Engineering" John Wiley & Sons, Inc. 4th edition, 2012
2. Samuel Y. Liao, "Microwave Devices and Circuits", PHI publications, Third Edition, 1997.
3. Gerd Keiser, "Optical Fiber Communications", McGraw Hill, Third Edition, 2000.

References:

1. R. E. Collin, "Foundations for Microwave Engineering", Wiley Student Edition, Second Edition, 2009.
2. Om. P. Gandhi, "Microwave: Engineering and Applications", Kai Fa Book Company, 1981.
3. Reich H. J., et al, "Microwave Principles", MIT Press, 1972.
4. F E Terman, "Electronic and Radio Engineering", McGraw Hill, 4th Edition, 1984

23A04603T	**VLSI DESIGN**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the steps involved in fabrication of ICs using MOS transistor technology.
2. To learn about theVLSI design processes, Stick diagrams and Layouts.
3. To gain knowledge on the Gate Level Design concepts.
4. To learn the design of various subsystems with different VLSI Design styles.
5. To get familiar with CMOS testing techniques.

Course Outcomes:

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

1. Understand the steps involved in fabrication of ICs using MOS transistor technology.
2. Learn about theVLSI design processes, Stick diagrams and Layouts.
3. Gain knowledge on the Gate Level Design concepts.
4. Learn the design of various subsystems with different VLSI Design styles.
5. Familiar with CMOS testing techniques.

UNIT I

Introduction: Brief Introduction to IC technology MOS, PMOS, NMOS, CMOS &BiCMOS Technologies. Basic Electrical Properties of MOS and BiCMOS Circuits: I_{DS} - V_{DS} relationships, MOS transistor Threshold Voltage, figure of merit, Trans conductance, Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT II

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Lambda(λ)-based design rules for wires, contacts and Transistors, Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits, Limitations of Scaling.

UNIT III

Gate level Design: Logic gates and other complex gates, Switch logic, Alternate gate circuits. Basic Circuit Concepts: Sheet Resistance Rs and its concepts to MOS, Area Capacitances calculations, Inverter Delays, Driving large Capacitive Loads, Wiring Capacitances, Fan-in and fan-out

UNIT IV

Subsystem Design: Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Counters. VLSI Design styles: Full-custom, Standard Cells, Gate-arrays, FPGAs, CPLDs and Design Approach for Full-custom and Semi-custom devices, parameters influencing low power design.

UNIT V

CMOS Testing: Need for testing, Design for testability - built in self-test (BIST) – testing combinational logic –testing sequential logic – practical design for test guide lines – scan design techniques.

Textbooks:

1. Essentials of VLSI Circuits and Systems, Kamran Eshraghian, EshraghianDougles, A. Pucknell, 2005, PHI.
2. Modern VLSI Design – Wayne Wolf, 3 Ed., 1997, Pearson Education.

References:

1. CMOS VLSI Design-A Circuits and Systems Perspective, Neil H.E Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.
2. BehzadRazavi , "Design of Analog CMOS Integrated Circuits", McGraw Hill, 2003.
3. Jan M. Rabaey, "Digital Integrated Circuits", AnanthaChandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.

III B.Tech II Sem(EE (VLSI Design and Technology))

23A41601	**SCRIPTING LANGUAGES FOR VLSI (Professional Elective II)**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To learn to use basic Linux commands to navigate directories, manipulate files, and manage system operations to support VLSI design automation.
2. To understand the fundamentals of Perl programming and how to use regular expressions for pattern matching.
3. To develop advanced Perl skills to automate system-level tasks in VLSI design.
4. To gain knowledge on TCL scripting and using it to manipulate data structures and execute I/O operations for system automation.
5. Gain proficiency in Python programming to automate tasks related to VLSI design and testing.

Course Outcomes:

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

1. To learn to use basic Linux commands to navigate directories, manipulate files, and manage system operations to support VLSI design automation.
2. To understand the fundamentals of Perl programming and how to use regular expressions for pattern matching.
3. To develop advanced Perl skills to automate system-level tasks in VLSI design.
4. To gain knowledge on TCL scripting and using it to manipulate data structures and execute I/O operations for system automation.
5. Gain proficiency in Python programming to automate tasks related to VLSI design and testing.

Unit-1:

Introduction to Linux Commands: Basic commands to navigate directories, create files, display contents and stats; Copy, rename, delete files; Basic process commands; Manipulate or parse file contents; Changing file attributes; Locate file and its type; System and user details.

Unit-2:

Introduction to PERL : Names and Values, Variables, Scalar Expressions, Control Structures, arrays, list, hashes, strings, pattern and regular expressions, subroutines.

Unit-3:

Advanced PERL: Finer points of looping, pack and unpack, file system, eval, data structures, packages, modules, objects, interfacing to the operating system.

Unit-4:

TCL: TCL Structure, syntax, Variables and Data in TCL, Control Flow, Data Structures, input/output, procedures, strings, patterns.

Unit-5:

Python: Introduction to Python language, python-syntax, statements, functions, Built-in-functions and Methods, Modules in python, Exception Handling.

Textbooks:

1. Linux Shell Scripting Cookbook, ShatanuTushar, SarathLakshman
2. Perl Power, J.RFlynt, Cengage Learning.
3. Tcl and the Tk Tool kit, John K Ousterhout, Pearson Education.
4. Programming Python, M.Lutz.

IIIB.Tech II Semester (EE (VLSI Design and Technology))

23A04604a	**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To know about the performance characteristics of instruments and measurement of electrical quantities.
2. To understand the construction, working and applications of different types of CRO's.
3. To analyze the working of different types of bridges.
4. To study the working of signal & function generators and analyzers.
5. To analyze the working of sensors and transducers in measuring physical parameters.

Course Outcomes:

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

1. Learn about the performance characteristics of instruments and measurement of electrical quantities.
2. Understand the construction, working and applications of different types of CRO's.
3. Compare the working of different types of bridges.
4. Know the working of signal & function generators and analyzers.
5. Grasp the working of sensors and transducers in measuring physical parameters.

UNIT-I

Performance characteristics of Instruments: Static characteristics, Accuracy, Precision, Resolution, Sensitivity, static and dynamic calibration, Errors in Measurement, and their statistical analysis, dynamic characteristics-speed of Response, fidelity, Lag and dynamic error. DC ammeters, DC voltmeters-multirange, range extension/solid state and differential voltmeters, AC voltmeters–multirange, range extension. Thermocouple type RF ammeter, ohm meters, series type, shunt type, multimeter for voltage, current and resistance measurements.

UNIT-II

Oscilloscopes: Introduction, Basic Principle, Standard specifications of CRO,CRT features, vertical and horizontal amplifiers, horizontal and vertical deflection systems, sweep trigger pulse, delay line, sync selector circuits, probes for CRO – active, passive, and attenuator type, triggered sweep CRO, and Delayed sweep, dual trace/beam CRO, Measurement of amplitude, frequency and phase (Lissajous method). Principles of sampling oscilloscope, storage oscilloscope, and digital storage oscilloscope, Digital frequency counters, time & Period measurements.

UNIT-III

Bridges: DC Bridges for Measurement of resistance: Wheat stone bridge, Kelvin's Bridge, AC Bridges for Measurement of inductance- Maxwell's bridge, Hay's Bridge, Anderson bridge. Measurement of capacitance- Schearing Bridge, Wien Bridge. Errors and precautions in using bridges.

UNIT-IV

Signal Generators: Signal generator-fixed and variable, AF oscillators, function generators, pulse, random noise, sweep, and arbitrary waveform generators, their standards, specifications and principles of working (Block diagram approach).Wave analyzers, Harmonic distortion analyzers, Spectrum analyzers, and Logic analyzers.

UNIT-V

Sensors and Transducers - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

TEXT BOOKS:

1. A.D. Helfrick and W.D. Cooper, "Modern Electronic Instrumentation and Measurement Techniques", 5th Edition, PHI, 2002.
2. H.S.Kalsi, "Electronic Instrumentation", 2nd edition, Tata McGraw Hill, 2004.

REFERENCES:

1. David A. Bell, "Electronic Instrumentation & Measurements", 2nd Edition, PHI, 2003.
2. K. Lal Kishore, "Electronic Measurements & Instrumentations", Pearson Education, 2009.

IIIB.Tech II Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04604b	**EMBEDDED SYSTEMS & IOT**	3	0	0	3

Course Objectives:

1. To understand the Architecture, Development & Design of Embedded Systems and IoT.
2. To learn the architecture and programming of ARM Microcontroller.
3. To be able to work with Raspberry Pi using Python Programming.
4. To know about the loT standards, communication technologies and protocols for IoT devices.
5. To implement case studies and applications using the tools and techniques of IoT Platform.

Course Outcomes:

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

1. Understand the Architecture, Development & Design of Embedded Systems and IoT.
2. Learn the architecture and programming of ARM Microcontroller.
3. Work with Raspberry Pi using Python Programming.
4. Know about the loT standards, communication technologies and protocols for IoT devices.
5. Implement case studies and applications using the tools and techniques of IoT Platform.

UNIT I

Introduction to Embedded Systems and Internet of Things (IoT): Introduction, Hardware & Software Architecture of Embedded Systems, Embedded Systems Development process, Architecture of Internet of Things, Physical Design & Logical Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Tools, Applications of Embedded Systems and IoT, Design Methodology for IOT Products.

UNIT II

ARM Microcontrollers Architecture and Programming: Architecture, Pin Diagram, Register Set & Modes, Memory Organization, Instruction set, Programming ports, Timer/Counter, Serial communication, I/O System, Development Tools, interrupts in C, Introduction ARM mBed platform.

UNIT III

Fundamentals of Python Programming & Raspberry Pi: Introduction to python programming, Data Types & Data Structures, working with functions, Modules & Packages, File Handling, classes, RESTfull Web Services, Client Libraries, Introduction & programming Raspberry Pi3, Interfaces, Integrating Input Output devices with Raspberry Pi3

UNIT IV

IoT Technologies, Standards, Tools & M2M Network: Fundamental characteristics and high-level requirements of IoT, IoT Reference models; Introduction to Communication Technologies & Protocols of IoT: BLE, Wi-Fi, LoRA, 3G/4G Technologies and HTTP, MQTT, CoAP protocols; Relevant Practicals on above technologies, M2M Network, SDN (Software Defined Networking) & NFV (Network Function Virtualization) for IoT

UNIT V

IoT Platform, Cloud Computing Platforms & Data Analytics for IoT Development: IOT Platform Architecture (IBM Internet of Things & Watson Platforms); API Endpoints for Platform Services; Devices Creation and Data Transmission; Introduction to NODE-RED and Application deployment, Introduction to Data Analytics, Apache Hadoop, Apache Oozie, Spark & Storm

TEXT BOOKS

1. ArsheepBahga, Vijay Madisetti, "Internet of Things: A Hands-On Approach", 1st Edition, VPT, 2014.
2. K.V.K.K.Prasad, "Embedded Real Time Systems: Concepts, Design and Programming", 1st Edition, Dreamtech Publication, 2014.
3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publications, 2013

REFERENCES

1. Jonathan W Valvano, "Embedded Microcomputer Systems: Real-Time Interfacing", 3rd Edition, Thomson Engineering, 2012.
2. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key applications and Protocols", 2nd Edition, Wiley Publications, 2012.
3. Rene Beuchat , Andrea Guerrieri & Sahand Kashani "Fundamentals of System-on-Chip Design on Arm Cortex-M Microcontrollers" Paperback, 2 August 2021.

III B.Tech I Sem (EE (VLSI Design and Technology))

23A41602	**TESTING OF VLSI CIRCUITS (Professional Elective III)**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the concepts of fault modelling, detectionfor digital circuits, and the role of simulation in fault diagnosis.
2. To develop test patterns and testable designs for combinational and sequential circuits.
3. To learn and apply design for testability (DFT) techniques to improve circuit testability.
4. To implement Built-In Self-Test (BIST) architectures for digital systems and understand how test patterns are generated for BIST.
5. To analyze test algorithms and fault detection methods for embedded RAMs, and design systems that can self-diagnose faults efficiently.

Course Outcomes:

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

1. Understand the concepts of fault modelling, detection for digital circuits, and the role of simulation in fault diagnosis.
2. Develop test patterns and testable designs for combinational and sequential circuits.
3. Learn and apply design for testability (DFT) techniques to improve circuit testability.
4. Implement Built-In Self-Test (BIST) architectures for digital systems and understand how test patterns are generated for BIST.
5. Analyze test algorithms and fault detection methods for embedded RAMs, and design systems that can self-diagnose faults efficiently.

UNIT-1

Basics of Testing And Fault Modeling: Introduction to Testing - Faults in digital circuits - Modeling of faults - Logical Fault Models - Fault detection - Fault location - Fault dominance - Logic Simulation - Types of simulation - Delay models - Gate level Event-driven simulation.

UNIT-2

Test Generation For Combinational and Sequential Circuits: Test generation for combinational logic circuits - Testable combinational logic circuit design - Test generation for sequential circuits - design of testable sequential circuits.

UNIT-3

Design for Testability: Design for Testability - Ad-hoc design - Generic scan based design - Classical scan based design – System level DFT approaches.

UNIT-4

Self-Test and Test Algorithms : Built-In Self-Test - Test pattern generation for BIST - Circular BIST - BIST Architectures - Testable Memory Design - Test algorithms - Test generation for Embedded RAMs.

UNIT-5

Fault Diagnosis Logic: Level Diagnosis - Diagnosis by UUT reduction - Fault Diagnosis for Combinational Circuits - Self-checking design - System Level Diagnosis.

Text Books:

1. M. Abramovici, M.A. Breuer and A.D. Friedman, "Digital Systems and Testable Design", Jaico Publishing House.
2. M.L. Bushnell and V.D. Agrawal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers.

Reference Books:

1. P.K. Lala, "Digital Circuit Testing and Testability", Academic Press, 2002.
2. A.L. Crouch, "Design Test for Digital IC's and Embedded Core Systems", Prentice Hall International.

III B.Tech II Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04605b	**ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**	3	0	0	3

Course Objectives:

1. To learnthe basics and problems of Artificial Intelligence with rationality and structure of agents.
2. To describe the search for solutions using various search strategies & algorithms for optimization.
3. To evaluate the representation of Agents with Propositional Logic in Shopping World.
4. To understand the concepts of Machine Learning with different Perspectives.
5. To analyze Decision Tree Representation with different problems& issues.

Course Outcomes:

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

1. To learnthe basics and problems of Artificial Intelligence with rationality and structure of agents.
2. To describe the search for solutions using various search strategies & algorithms for optimization.
3. To evaluate the representation of Agents with Propositional Logic in Shopping World.
4. To understand the concepts of Machine Learning with different Perspectives.
5. To analyze Decision Tree Representation with different problems& issues.

UNIT I

Introduction: What is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT II

Problem Solving: Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, informed (Heuristic) Search Strategies, Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions.

UNIT III

Knowledge Representation: Knowledge-Based Agents, Logic, Propositional Logic: A Very Simple Logic, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, The Internet Shopping World.

UNIT IV

Introduction to Machine Learning: Well-Posed Learning Problem, Designing a Learning system, Perspectives and Issues in Machine Learning.

Concept Learning and The General-to-Specific Ordering: Introduction, A Concept Learning Task, Concept Learning as Search, FIND-S: Finding a Maximally Specific Hypothesis, Version Spaces and the Candidate Elimination Algorithm, Remarks on Version spaces and Candidate-Elimination, Inductive Bias

UNIT V

Decision Tree Learning: Introduction, Decision Tree Representation, Appropriate Problems for Decision Tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning, Inductive Bias in Decision Tree Learning, Issues in Decision Tree Learning.

Text Books:

1) Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Pearson
2) Tom M. Mitchell, *Machine Learning*, McGraw Hill Edition, 2013

Reference Books:

1) Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011
2) Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill
3) David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010.
4) Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.
5) Christopher Bishop, Pattern Recognition and Machine Learning (PRML) , Springer, 2007.
6) ShaiShalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms (UML) , Cambridge University Press, 2014.

III B.Tech II Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04605c	**SATELLITE COMMUNICATIONS**	3	0	0	3

Course Objectives:

1. To learn the principles of orbital mechanics& satellite launch system with performance parameters.
2. To describe the elements of communication satellite design for matching reliability.
3. To know the working concepts of various multiple access techniques and Onboard processing.
4. To analyze the satellite links design with communication links.
5. To evaluate the working of earth station design with satellite broadcasting.

Course Outcomes:

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

1. Learn the principles of orbital mechanics& satellite launch system with performance parameters.
2. Describe the elements of communication satellite design for matching reliability.
3. Gain knowledge on various multiple access techniques and Onboard processing.
4. Analyze the satellite links design with communication links.
5. Evaluate the working of earth station design with satellite broadcasting.

UNIT I

Elements of orbital mechanics. Equations of motion. Tracking and orbit determination. Orbital correction/control. Satellite launch systems. Multistage rocket launchers and their performance

UNIT II

Elements of communication satellite design. Spacecraft subsystems. Reliability considerations. Spacecraft integration.

UNIT III

Multiple access techniques. FDMA, TDMA,CDMA. Random access techniques. Satellite onboard processing.

UNIT IV

Satellite link design: Performance requirements and standards. Design of satellite links – DOMSAT, INSAT, INTELSAT and INMARSAT. Satellite - based personal communication. links.

UNIT V

Earth station design.Configurations.Antenna and tracking systems.Satellite broadcasting.

Textbooks:

1. D. Roddy, Satellite Communication (4/e), McGraw- Hill, 2009.
2. T. Pratt & C.W. Bostain, Satellite Communication, Wiley 2000.

References:

- B.N. Agrawal, Design of Geosynchrons Spacecraft, Prentice- Hall,1986.

III B.Tech II Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04602P	**MICROWAVE AND OPTICAL COMMUNICATIONS LAB**	0	0	3	1.5

Course Objectives:

1. To understand the working of microwave bench set up and characteristics of microwave sources.
2. To verify the characteristics of various microwave componentsand to draw the radiation pattern of antennas.
3. To verify the characteristics of optical sources & detectors and to study about losses in optical fiber.

Course Outcomes:

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

1. Understand the working of microwave bench set up and characteristics of microwave sources.
2. Verify the characteristics of various microwave componentsand to draw the radiation pattern of antennas.
3. Verify the characteristics of optical sources & detectors and to study about losses in optical fiber.

PART-A: Microwave Lab - Any Seven (7) Experiments

1. Reflex Klystron Characteristics
2. Gunn Diode Characteristics
3. Attenuation Measurement
4. Directional Coupler Characteristics
5. VSWR Measurement
6. Impedance Measurements
7. Frequency and Wavelength measurement
8. Scattering Parameters of Directional coupler
9. Scattering Parameters of Magic TEE
10. Radiation pattern measurement of a Antenna
11. Antenna gain measurement

Part B: Optical Fiber Lab - Any five (5) Experiments

11. Characterization of LED
12. Characterization of Laser Diode
13. Intensity Modulation of Laser output through Optical fiber
14. Measurement of data rate for digital Optical link
15. Measurement of Numerical Aperture.
16. Measurement of Losses for Analog optical link

III B.Tech II Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04603P	**VLSI DESIGN LAB**	0	0	3	1.5

Course Outcomes:

1. To design a logic circuit using CMOS transistorusing 180 nm technology in terms of schematic, symbol, test bench, DC and AC analysis.
2. To evaluate different schematics &output responses for AOI logic by using different software tools.
3. To design CMOS circuits using Full & Semi custom IC designsfor analyzation.
4. To design different layouts using different software tools for analogcircuits.

Course Objectives:

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

1. Design a logic circuit using CMOS transistorusing 180 nm technology in terms of schematic, symbol, test bench, DC and AC analysis.
2. Evaluate different schematics &output responses for AOI logic by using different software tools.
3. Design CMOS circuits using Full & Semi custom IC designsfor analyzation.
4. Design different layouts using different software tools for analogcircuits.

List of Experiments: (Any TEN of the experiments are to be conducted)

1. **Design and analysis of CMOS Inverter**
   a) Implement CMOS inverter schematic using 180 nm technology and design its symbol.
   b) Implement test bench for CMOS Inverter and check its output response.
   c) Perform DC and AC analysis for CMOS inverter.
   d) Check the performance of CMOS inverter using parametric sweep.

2. **Design and analysis of NAND and NOR Logic gates**
   a) Implement NAND/NOR schematic using 180 nm technology and design its symbol.
   b) Implement test bench for NAND/NOR and check its output response.
   c) Perform DC and AC analysis for NAND/NOR.
   d) Check the performance of NAND/NOR using parametric sweep.

3. **Design and analysis of XOR and XNOR Logic gates**
   a) Implement XOR/XNOR schematic using 180 nm technology and design its symbol.
   b) Implement test bench for XOR/XNOR and check its output response.
   c) Perform DC and AC analysis for XOR/XNOR.
   d) Check the performance of XOR/XNOR using parametric sweep.

4. Design of AOI logic

a) Design Schematic for AB+C‘D and check its output response.
b) Design Schematic for AB‘+C‘D and check its output response.
c) Design Schematic for (A+B‘)(C+D) and check its output response.
d) Design Schematic for (A+B‘)(C‘+D) and check its output response.

5. Design and analysis of Full adder

a) Design full adder using Full custom IC design.
b) Design full adder using Semi custom IC design.

6. Analysis of NMOS and PMOS characteristics

a) Implement test bench for NMOS/PMOS transistor.
b) Perform DC and AC analysis for NMOS/PMOS transistor
c) Check the performance of NMOS/PMOS transistor using parametric sweep.

7. Design and analysis of Common source amplifier

a) Implement CS amplifier schematic using 180 nm technology and design its symbol.
b) Implement test bench for CS amplifier and check its output response.
c) Perform DC and AC analysis for CS amplifier.
d) Check the performance of CS amplifier using parametric sweep.

8. Design and analysis of Common drain amplifier

a) Implement CD amplifier schematic using 180 nm technology and design its symbol.
b) Implement test bench for CD amplifier and check its output response.
c) Perform DC and AC analysis for CD amplifier.
d) Check the performance of CD amplifier using parametric sweep.

9. Design of MOS differential amplifier

a) Design differential amplifier schematic using 180 nm technology and its symbol.
b) Implement test bench for differential amplifier and check its output response.
c) Perform DC and AC analysis for differential amplifier.
d) Check the performance of differential amplifier using parametric sweep.

10. Design of differential amplifier using FET/BJT

a) Design differential amplifier using FET/BJT schematic using 180 nm technology and its symbol.
b) Implement test bench for two stage differential amplifier and check its output response.
c) Perform DC and AC analysis for differential amplifier.
d) Check the performance of differential amplifier using parametric sweep.

11. Design of Inverter Layout

a) Design and implement inverter schematic.
b) Design the layout for inverter using 180 nm tech file.

c) Perform LVS for schematic and layout
d) Check and remove all DRC violations.
e) Extract parasitic R and C in layout.

12. Design of NAND/NOR Layout

a) Design and implement NAND/NOR schematic.
b) Design the layout for inverter using 180 nm tech file.
c) Perform LVS for schematic and layout
d) Check and remove all DRC violations.
e) Extract parasitic R and C in layout

The students are required to design the schematic diagrams using CMOS logic and to draw the layout diagrams to perform the experiments with the Industry standard EDA Tools.

Software Required: i. Mentor Graphics/ Synopsis/ Cadence / Equivalent Industry Standard Software. ii. Personal computer system with necessary software to run the programs and to implement.

III B.Tech II Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04607	**MACHINE LEARNING AND DSP (SEC-IV)**	0	1	2	2

Course Objectives:

1. To understand the modules and dependencies for machine learning corresponding to different applications.
2. To understand a range of machine learning regression techniques & clustering along with their datasets.
3. To write the programs and implement k-Nearest Neighbor algorithm to classify the iris data sets, images & CNN.
4. To simulate the basic signal processing operations like convolution and correlation.
5. To simulate the DSP operations like DFT, FFT & implement IIR and FIR filters using simulation software and verify their frequency responses.

Course Outcomes:

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

1. Understand the modules and dependencies for machine learning corresponding to different applications.
2. Learn a range of machine learning regression techniques & clustering along with their datasets.
3. Write the programs and implement k-Nearest Neighbor algorithm to classify the iris data sets, images & CNN.
4. Simulate the basic signal processing operations like convolution and correlation.
5. Simulate the DSP operations like DFT, FFT & implement IIR and FIR filters using simulation software and verify their frequency responses.

MACHINE LEARNING (Implement any six concepts)

Implementthefollowingconceptsusingpythonwithsupportingapplications.

1. Familiarizing with Anaconda and Jupyter for importing modules and dependencies for ML Familiarization with NumPy, Panda and Matplotlib by Loading Dataset in Python
2. **Linear regression***:* Predict the profit of a company/House price from a dataset using the concept of linear regression. Implement the speech recognition model (NLP) from a speech/audio dataset using the concept of linear regression
3. **Logistic regression***:* a. Identify whether the patient has diabetes or not from diabetes dataset using Logistic regression

   b. Implement the speech to text model (NLP- Speech recognitions system) from a speech dataset using the concept of linear regression.

4. **Polynomial regression** *:*
   a. Determine the quality of wine using wine dataset with the help of polynomial regression
   b. Implementthespeechrecognitionmodel(NLP)fromaspeech/audiodatasetusingthe concept of polynomial regression.
5. **K-means clustering***:* Apply the concept of K-means clustering for image segmentation problem (Brain tumor and Lung images)/Color quantization
6. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set to demonstrate the working of the decision tree based ID3 algorithm.
7. Write a program to implement the k-Nearest Neighbor algorithm for image classification and distance metric learning for large margin with image classification applications using k-nearest neighbor.
8. **PCA/LDA:** Reduce the dimensionality of a dataset for Face recognition system.
9. Design an Artificial neural network for Digit classification using Back Propagation Algorithm for MNIST Dataset. Train MLP using Gradient descent algorithm by applying Linear, Sigmoid, tanh, and ReLu activation functions
10. **Digit Recognition Using CNN**:IdentifythedigitsO-9fromMNISTdataandCIFR10setusing CNN.
11. **ImageClassificationusingCNN:**ClassifycatsanddogsusingCNNfromthegivendataset.
12. LSTM (Long Short-Term Memory Networks)/ARIMA--- Implementation biomedical signals (like EEG, ECG, EMG) classifications and disease prediction.

DIGITAL SIGNAL PROCESSING (Implement any six concepts)

1. Generate the following standard discrete time signals.
   i) Unit Impulse **ii)** Unit step **iii)** Ramp **iv)** Exponential **v)** Sawtooth
2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.
5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
7. Implement and verify N-point IFFT of a given sequence.
8. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
9. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).
10. Design FIR filter (Low Pass Filter /High Pass Filter) using windowing technique.
    i)Using rectangular window, **ii)** Using hamming window, **iii)** Using Kaiser window
11. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.

12. Compute the Decimation and Interpolation for the given signal.
13. Real time implementation of an audio signal using a digital signal processor.

Reference books:

1. S.N.SivanandamandS.N.Deepa,IntroductiontoneuralnetworksusingMatlab,2006.
2. SimonHaykin,NeuralNetworksandLearningMachines,PHI,2008, 3rd Edition
3. Digital Signal Processing: Alon V. Oppenhelm, PHI
4. Digital Signal processing(II-Edition): S.K. Mitra, TMH

Semester V

23A52601	**TECHNICAL PAPER WRITING AND INTELLECTUAL PROPER RIGHTS**	**L**	**T**	**P**	**C**
		2	0	0	0

Course Objectives:·

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

Course Outcomes: On successful completion of this course, the students will be able to:

COURSE OUTCOMES: At the end of the course, students will be able to		**Blooms Level**
CO1	Identify key secondary literature related to their proposed technical pape writing	L1, L2
CO2	Explain various principles and styles in technical writing	L1, L2
CO3	Use the acquired knowledge in writing a research/technical paper	L3
CO4	Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc.	L4
CO5	Evaluate different forms of IPR available at national & international level	L5
CO6	Develop skill of making search of various forms of IPR by using modern tools and techniques.	L3, L6

UNIT – I:

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence andlogical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings-discussing your limitations -hedging and criticizing -plagiarism and paraphrasing .

UNIT – II:

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review

of Literature- Problemsand Framing Research Questions- Synopsis

UNIT – III:

Process of research: publication mechanism: types of journals- indexing-seminars-

conferences- proof reading –plagiarism style; seminar & conference paper writing;

Methodology-discussion-results- citation rules

UNIT – IV:

oduction to Intellectual property: Introduction, types of intellectual property, International organizations, ncies and treaties, importance of intellectual property rights

de Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting evaluating trade mark, trade mark registration processes.

UNIT – V:

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.Patent law, intellectual property audits.

Textbooks:

1. Deborah. E. Bouchoux, *Intellectual Property Rights*, Cengage Learning India, 2013
2. Meenakshi Raman, Sangeeta Sharma. *Technical Communication:Principles and practices*.Oxford.

Reference Books:

1. R.Myneni, *Law of Intellectual Property*, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli,*Intellectual Property Rights* Tata Mcgraw Hill, 2001
3. P.Naryan,*Intellectual Property Law*, 3rd Ed ,Eastern Law House, 2007.
4. Adrian Wallwork. *English for Writing Research Papers*Second Edition. Springer Cham Heidelberg New York ,2016
5. Dan Jones, Sam Dragga, *Technical Writing Style*

Online Resources

1. https://theconceptwriters.com.pk/principles-of-technical-writing/

2. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html

3. https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html
4. https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/
5. https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf
6. https://lawbhoomi.com/intellectual-property-rights-notes/
7. https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf

IVB.Tech I Semester (EE (VLSI Design and Technology))

23A41701	**FPGA ARCHITECTURES AND ASICs**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the concept, evolution, applications, and design methodologiesof FPGAs and ASICs.
2. To learn the internal architecture of FPGAs**,** including logic blocks, interconnects, embedded resources, and clock management.
3. To implement the FPGA design flow**,** including synthesis, optimization, placement, routing, and bit-stream generation.
4. To develop FPGA-based designs using VHDL**,** focusing on both sequential and concurrent logic implementation .
5. To optimize FPGA designs for performance and power efficiencyusing best practices.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand the concept, evolution, applications, and design methodologiesof FPGAs and ASICs.
2. Learn the internal architecture of FPGAs, including logic blocks, interconnects, embedded resources, and clock management.
3. Implement the FPGA design flow**,** including synthesis, optimization, placement, routing, and bit-stream generation.
4. Develop FPGA-based designs using VHDL**,** focusing on both sequential and concurrent logic implementations.
5. Optimize FPGA designs for performance and power efficiencyusing best practices.

UNIT-1

An Introduction to FPGAs: Definition and Overview, Historical Evolution, Applications and Use Cases, Advantages and Limitations of FPGAs, types of FPGAs, The difference between full-custom and semicustom ASICs, The difference between standard-cell, gate-array, and programmable ASICs,ASIC design flow, ASIC cell library.

UNIT-2

FPGA Architecture: FPGA Chip, Configurable Logic Blocks (CLBs), Input/Output Blocks (IOBs), Programmable Interconnect, Embedded Resources, Clock Management Resources, Configuration and Programming, System-on-Chip Architecture (SoC)

UNIT-3

FPGA Design Flow: An overview of design flow, Hardware Description Languages, Synthesis and Optimization, Floorplan, Place and Route, Bitstream Generation, Programming and Configuration, Types of Cores.

UNIT-4

FPGA Programming Languages:VHDL, Sequential Statements, Concurrent Statements, Synchronous and Asynchronous Logic, Hierarchical Design and Module Instantiation, VHDL Data Types and Conversions, Advanced VHDL Techniques.

UNIT-5

Design Techniques and Best Practices: RTL Design, Finite State Machines, Timing Constraints, Pipelining and Parallelism, Power Optimization.Testing:Simulation-Based Testing, Testbench Development, On-Chip Logic Analyzer

Text Books:

1. Stephen M. Trimberger, "Field-Programmable Gate Array Technology" Springer.
2. Pong P. Chu, “FPGA Prototyping by VHDL Examples: Xilinx Spartan-3 Version" Wiley-Interscience.

Reference:

1. CemUnsalan and Bora Tar,"Digital System Design with FPGA: Implementation Using Verilog and VHDL",McGraw-Hill Education,1st edition, 2017
2. Bob Zeidman, Barnes &NobleBooks , "Designing with FPGAs and CPLDs"

IV B.Tech I Semester

		L	T	P	C
23A52701a	**Management Course- II** **BUSINESS ETHICS AND CORPORATE GOVERNANCE**	2	0	0	2

COURSE OBJECTIVES : The objectives of this course are	
1	To make the student understand the principles of business ethics
2	To enable them in knowing about the ethics in management
3	To facilitate the student' role in corporate culture
4	To impart knowledge about the fair-trade practices
5	To encourage the student in knowing about the corporate governance

UNIT-I: Ethics

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior.. Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management -Corporate Social Responsibility – Issues of Management – Crisis Management.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the meaning of loyalty and ethical Behavior
- Explain various types of Ethics
- Analyze issues & crisis of management

UNIT-II: ETHICS IN MANAGEMENT

Introduction- Ethics in production, finance, Human resource management and Marketing Management - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the meaning of Ethics in various areas of management
- Compare and contrast professional ethics and technical ethics
- Develop ethical values in self and organization

UNIT-III : CORPORATE CULTURE

Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture,

hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change.

LEARNING OUTCOMES:- After completion of this unit student will

- Define corporate culture
- Understand the key elements of corporate culture
- Analyze organization leadership and corporate culture

UNIT- IV: LEGAL FRAME WORK

Law and Ethics -Agencies enforcing Ethical Business Behavior - Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand Law and Ethics
- Analyze Different fair trade practices
- Make use of Environmental Protection and Fair Trade Practices

UNIT -V: CORPORATE GOVERNANCE

Introduction - Meaning – Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work - Corporate scams - Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee - Various committees - Reports - Benefits and Limitations.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand corporate governance code
- Analyze role of auditors, board of directors and shareholders in corporate governance
- Implementing corporate social responsibility in India.

Text books.

1. Murthy CSV: Business Ethics and Corporate Governance, HPH July 2017

2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH. June 2010

Reference books

1. Dr. K. Nirmala, KarunakaraReaddy. *Business Ethics and Corporate Governance*, HPH

2. H.R.Machiraju: *Corporate Governance*, HPH, 2013

3. K. Venkataramana, *Corporate Governance*, SHBP.

4. N.M.Khandelwal. *Indian Ethos and Values for Managers*

COURSE OUTCOMES: At the end of the course, students will be able to		**BTL**
CO1	Understand the Ethics and different types of Ethics.	L2
CO2	Understand business ethics and ethical practices in management	L2
CO3	Understand the role of ethics in management	L2
CO4	Apply the knowledge of professional ethics & technical ethics	L3
CO5	Analyze corporate law, ethics, codes & principles	L4
CO6	Evaluate corporate governance & corporate scams	L5

BTL = Bloom's Taxonomy Level

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/
2. https://archive.nptel.ac.in/courses/110/105/110105138/
3. https://onlinecourses.nptel.ac.in/noc21_mg54/
4. https://onlinecourses.nptel.ac.in/noc22_mg54/
5. https://archive.nptel.ac.in/courses/109/106/109106117/

23A52701b	**Management Course- II** E-BUSINESS **(Elective-2 VII - SEMESTER)**	**L**	**T**	**P**	**C**
		2	0	0	2

Course Objectives: The Objectives of this course are	
1	To provide knowledge on emerging concept on E-Business related aspect.
2	To understand various electronic markets & business models.
3	To impart the information about electronic payment systems & banking.
4	To create awareness on security risks and challenges in E-commerce.
5	To the students aware on different e-marketing channels & strategies.

Syllabus

Unit-I: Electronic Business

Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce –E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

Learning Outcomes: -After completion of this unit student

- Understand the concept of E-Business
- Contrast and compare E-Commerce & E-Business
- Evaluate opportunities of E-commerce for industry

Unit-II: Electronic Markets and Business Models

Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals -Business Models- Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions-B2B Portals in India

Learning Outcomes: -After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals

- Analyze the B2B,B2C and B2G model

Unit-III: Electronic Payment Systems:

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions -Infrastructure requirements and regulatory aspects of e-payments

Learning Outcomes: -After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and smart cards
- Analyze debit card and credit cards

Unit-IV:E-Security

Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) -Firewalls in securing e-business platforms.

Learning Outcomes: -After completion of this unit student will

- Understand E-Security
- Contrast and compare security protocols and public network
- Evaluate on Digital signature

Unit-V:E-Marketing:

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research– – E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM)

Learning Outcomes: -After completion of this unit student will

- Understand the concept of online marketing
- Apply the knowledge of online marketing
- Compare e-CRM and e-SCM

Text Books:

1. Arati Oturkar&Sunil Khilari. *E-Business*. Everest Publishing House, 2022
2. P.T.S Joseph. *E-Commerce*, Fourth Edition, Prentice Hall of India, 2011

References:

1. Debjani, Kamalesh K Bajaj. *E-Commerce*, Second Edition Tata McGraw-Hill's, 2005
2. Dave Chaffey.*E-Commerce E-Management*, Second Edition, Pearson, 2012.
3. Henry Chan. *E-Commerce Fundamentals and Application*, RaymondLeathamWiley India 2007
4. S. Jaiswal. *E-Commerce* GalgotiaPublication Pvt Ltd., 2003.

COURSE OUTCOMES: At the end of the course student will be able to		**BTL**
CO1	Remember E-Business & its nature, scope and functions.	L1
CO2	Understand E-market-Models which are practicing by the organizations	L2
CO3	Apply the concepts of E-Commerce in the present globalized world.	L3
CO4	Analyze the various E-payment systems & importance of net banking.	L4
CO5	Evaluate market research strategies & E-advertisements.	L5
CO6	Understand importance of E-security & control	L2

BTL = Bloom's Taxonomy Level

Online Resources:

https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771

https://www.slideshare.net/VikramNani/e-commerce-business-models

https://www.slideshare.net/RiteshGoyal/electronic-payment-system

https://www.slideshare.net/WelingkarDLP/electronic-security

https://www.slideshare.net/Ankitha2404/emarketing-ppt

23A52701c	**Management Science**	**L**	**T**	**P**	**C**
		2	0	0	2

COURSE OBJECTIVES : The objectives of this course are	
1	To provide fundamental knowledge on Management, Administration, Organization & its concepts.
2	To make the students understand the role of management in Production
3	To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
4	To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
5	To make the students aware of the contemporary issues in modern management

UNIT- IINTRODUCTION TO MANAGEMENT

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Elton Mayo's Human relations - **Organizational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand the concept of management and organization
- Apply the concepts & principles of management in real life industry.
- Analyze the organization chart & structure of an enterprise.

UNIT - II OPERATIONS MANAGEMENT

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - **Marketing Management** - Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand the core concepts of Operations Management

- Apply the knowledge of Quality Control, Work-study principles in real life industry.
- Evaluate Materials departments & Determine EOQ
- Analyze Marketing Mix Strategies for an enterprise.
- Create and design advertising and sales promotion

UNIT - III HUMAN RESOURCES MANAGEMENT (HRM)

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process - Employee Training and Development - methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

LEARNING OUTCOMES: At the end if the Unit, the students will be able to

- Understand the concepts of HRM, Recruitment, Selection, Training & Development
- Analyze the need of training
- Evaluate performance appraisal
- Design the basic structure of salaries and wages

UNIT - IV STRATEGIC & PROJECT MANAGEMENT

Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).

LEARNING OUTCOMES: At the end of the Unit, the students will be able to

- Understand Mission, Objectives, Goals & strategies for an enterprise
- Apply SWOT Analysis to strengthen the project
- Analyze Strategy formulation and implementation
- Evaluate PERT and CPM Techniques

UNIT - V CONTEMPORARY ISSUES IN MANAGEMENT

Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management – employee engagement and retention - Business Process Re-engineering and Bench Marking - Knowledge Management – change management – sustainability and corporate social responsibility.

LEARNING OUTCOMES At the end if the Unit, the students will be able to

- Understand modern management techniques
- Apply Knowledge in Understanding in TQM, SCM
- Analyze CRM, BPR
- Evaluate change management & sustainability

Text Books:

1. Frederick S. Hillier, Mark S. Hillier. *Introduction to Management Science*, October 26, 2023

2. A.R Aryasri, *Management Science*, TMH, 2019

References:

1. Stoner, Freeman, Gilbert.*Management*, Pearson Education, New Delhi, 2019.

2. Koontz & Weihrich, *Essentials of Management*, 6/e, TMH, 2005.

3. Thomas N.Duening & John M.Ivancevich, *Management Principles and Guidelines*, Biztantra.

4. Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.

5. Samuel C.Certo, *Modern Management*, 9/e, PHI, 2005

COURSE OUTCOMES: At the end of the course, students will be able to		**BTL**
CO1	Remember the concepts & principles of management and designs of organization in a practical world	**L1**
CO2	Understand the knowledge of Work-study principles & Quality Control techniques in industry	**L2**
CO3	Apply the process of Recruitment & Selection in organization.	**L3**
CO4	Analyze the concepts of HRM & different training methods.	**L4**
CO5	Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.	**L5**
CO6	Create awareness on contemporary issues in modern management & technology.	**L3**

BTL = Blooms Taxonomy Level

ONLINE RESOUECES:

1. https://www.slideshare.net/slideshow/introduction-to-management-and-organization-231308043/231308043
2. https://nptel.ac.in/courses/112107238
3. https://archive.nptel.ac.in/courses/110/104/110104068/
4. https://archive.nptel.ac.in/courses/110/105/110105069/
5. https://onlinecourses.nptel.ac.in/noc24_mg112/

IVB.Tech I Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04703a	**LOW POWER VLSI DESIGN (Professional Elective IV)**	3	0	0	3

Course Objectives:

1. To identify and analyze different sources of power dissipationin VLSI circuits.
2. To explore supply voltage scaling techniquessuch as parallelism, pipelining, and multi-core architectures to reduce power consumption.
3. To design low-power arithmetic circuits, including various adder architectures like ripple carry, carry look-ahead, carry select, and carry skip adders.
4. To implement low-power multipliersusing optimized design techniques.
5. To understand the fundamentals of adiabatic logicand energy recovery logic circuits.

Course Outcomes:

After completing the course, the student will be able to,

1. Identify and analyze different sources of power dissipationin VLSI circuits.
2. Explore supply voltage scaling techniquessuch as parallelism, pipelining, and multi-core architectures to reduce power consumption.
3. Design low-power arithmetic circuits**,** including various adder architectures like ripple carry, carry look-ahead, carry select, and carry skip adders.
4. Implement low-power multipliersusing optimized design techniques.
5. Understand the fundamentals of adiabatic logicand energy recovery logic circuits.

UNIT-I

Fundamentals of Low Power VLSI Design: Need for Low Power Circuit Design, Sources of Power Dissipation-Dynamic Power Dissipation, Short Circuit Power Dissipation, Static Power-Reverse diode leakage current, Sub threshold leakage current. Glitching Power Dissipation.

UNIT-II:

Supply Voltage Scaling for Low Power: Introduction, Device Feature Size Scaling-Constant-Field Scaling, Constant-Voltage Scaling, Short-Channel Effects, Architectural Level Approaches-Parallelism for Low Power, Multi-Core for Low Power, Pipelining for Low Power, Multilevel Voltage Scaling.

UNIT-III

Low-Voltage Low-Power : Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Look-Ahead Adders, Carry Select Adders, Carry Save Adders, Carry Skip Adders.

UNIT-IV

Low-Voltage Low-Power Multipliers : Overview of Multiplication, types of multiplier architectures-Braun and Baugh-Wooley multiplier Booth Multiplier-Booth's algorithm, modified Booth algorithm, Introduction to Tree Multiplier (Wallace and Dada multipliers) and 4:2 Compressors

UNIT-V

Adiabatic Logic Circuits: Introduction, Adiabatic Charging, Adiabatic Amplification, Adiabatic Logic Gates, Pulsed Power Supply, Stepwise Charging Circuits, Stepwise Driver Using Tank Capacitors, Partially Adiabatic Circuits- Efficient Charge Recovery Logic, Positive Feedback Adiabatic Logic Circuits, 2N−2N2P Inverter/Buffer.

Text Books:

1. Ajit Pal, Low-Power VLSI Circuits and Systems, Springer, August 2016
2. Kiat-Seng Yeo, Kaushik Roy, Low-Voltage, Low-Power VLSI Subsystems, TMH Professional Engineering. 7th Edition, 2009

References:

1. Sung-Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits – Analysis and Design, TMH, 2011.
2. AnanthaChandrakasan, Low Power CMOS Design , IEEE Press/Wiley International, 1998.
3. Gary K. Yeap, Practical Low Power Digital VLSI Design, Kluwer Academic Press, 2002.
4. Kaushik Roy, Sharat C. Prasad, Low Power CMOS VLSI Circuit Design , John Wiley & Sons, 2000.

IVB.Tech I Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04702b	**DSP PROCESSORS & ARCHITECTURES**	3	0	0	3

Course Objectives:

1. To describe the unique features and significance of Digital Signal Processing (DSP).
2. To demonstrate various computational parameters and accuracy considerations in DSP systems.
3. To introduce architectural improvements in programmable DSP devices and their execution models.
4. To expose students to basic DSP algorithms, including filtering, FFT, and adaptive processing.
5. To outline DSP processor applications and their interfacing with memory and I/O peripherals.

Course Outcomes:

After completing the course, the student will be able to,

1. Summarize the fundamental features and role of Digital Signal Processing in real-world applications.
2. Evaluate dynamic range, precision, and error sources in DSP implementations.
3. Explain the architectural features of DSP processors and their computational efficiency.
4. Analyze the performance of DSP algorithms on programmable DSP platforms for specific applications.
5. Select and implement DSP processors for real-time applications, including memory and peripheral interfacing.

UNIT-I

Introduction to Digital Signal Processing: Introduction, a Digital signal-processing system, the sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB.

Computational Accuracy in DSP Implementations: Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT-II

Architectures for Programmable DSP Devices: Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing.

Execution Control and Pipelining: Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models.

UNIT-III

Programmable Digital Signal Processors: Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On- Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

UNIT-IV

Implementations of Basic DSP Algorithms: The Q-notation, FIR Filters, IIR Filters, Interpolation Filters, Decimation Filters, PID Controller, Adaptive Filters, 2-D Signal Processing.

Implementation of FFT Algorithms: An FFT Algorithm for DFT Computation, A Butterfly Computation, Overflow and scaling, Bit-Reversed index generation, An 8-Point FFT implementation on the TMS320C54XX, Computation of the signal spectrum.

UNIT-V

Interfacing Memory and I/O Peripherals to Programmable DSP Devices: Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

TEXT BOOKS:

1. Avtar Singh and S. Srinivasan, "Digital Signal Processing Implementation", 1st Edition, Cengage Learning, 2004.
2. Lapsley et al. S. Chand and Co, "DSP Processor Fundamentals, Architectures & Features", 2000.

REFERENCES:

1. B. Venkata Ramani and M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications", TMH, 2004.
2. Jonatham Stein, "Digital Signal Processing: A Computer Science Perspective", John Wiley, 2000.

IV B.Tech I Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04702c	**CELLULAR & MOBILE COMMUNICATIONS**	3	0	0	3

Course Objectives:

1. To explain the basic cellular system and its working.
2. To understand the impact of multipath fading channels and techniques to mitigate fading effects in cellular communication.
3. To explore frequency management, channel assignment strategies, and different types of handoffs in cellular networks.
4. To analyze the performance of mobile antennas, interference issues, and cellular system design principles.
5. To evaluate system performance metrics such as dropped call rates, handoff strategies, and spectrum efficiency.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand the basic cellular system and its working.
2. Explain the impairments caused by multipath fading and methods to mitigate fading effects in mobile communication.
3. Apply concepts of cellular communication to solve problems related to mobile antennas and system design.
4. Analyze co-channel and non-co-channel interferences, different types of handoffs, and dropped call rates.
5. Evaluate the performance of cellular systems, including signal reception, handoff efficiency, and spectrum utilization.

UNIT I

Cellular Mobile Radio Systems: Introduction to Cellular Mobile system, basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, Hexagonal shaped cells, Analog and Digital Cellular systems.

UNIT II

Elements of Cellular Radio System Design: General description of the problem, concept of frequency channels, Co-channel Interference Reduction Factor, desired C/I from a normal case in a Omni directional Antenna system, Cell splitting, consideration of the components of cellular system.

Interference: Introduction to Co-channel interference, real time co-channel interference, Co-channel measurement, design of Antenna system, Antenna parameters and their effects, diversity receiver, non-co-channel interference-different types.

UNIT III

Cell Coverage for Signal and Traffic: Signal reflections in flat and hilly terrain, effect of human made structures, phase difference between direct and reflected paths, constant standard deviation, straight line path loss slope, general formula for mobile propagation over water and flat open area, near and long-distance propagation antenna height gain, form of a point-to-point model.

UNIT IV

Cell Site and Mobile Antennas: Sum and difference patterns and their synthesis, Omni directional antennas, directional antennas for interference reduction, space diversity antennas, umbrella pattern antennas, minimum separation of cell site antennas, high gain antennas.

Frequency Management and Channel Assignment: Numbering and grouping, setup access and paging channels channel assignments to cell sites and mobile units, channel sharing and borrowing, sectorization, overlaid cells, non fixed channel assignment.

UNIT V

Handoff: Handoff, dropped calls and cell splitting, types of handoffs, handoff invitation, delaying handoff, forced handoff, mobile assigned handoff. Intersystem handoff, cell splitting, micro cells, vehicle locating methods, dropped call rates and their evaluation.

System Evaluations: Performance evaluation, Signal evaluation, Measurement of average received level and level crossings, Spectrum efficiency evaluation.

TEXT BOOKS:

1. W .C. Y. Lee, “Mobile cellular telecommunications”, Tata Mc-Graw Hill, 2nd Edition, 2006.
2. Theodore. S. Rapport, “Wireless communications”, Pearson Education, 2ndEdn., 2002.

REFERENCES:

1. Gordon L. Stuber, “Principles of Mobile communications”, Springer International 2nd Edition, 2007.
2. Lee , “Wireless and Mobile Communications”, Mc Graw Hills, 3rd Edition, 2006.
3. Jon W.Mark and WeihuaZhqung, “Wireless communications and Networking”, PHI, 2005.
4. R.Blake, “Wireless communication Technology”, Thompson Asia Pvt.Ltd., 2004.

IVB.Tech I Semester (EE (VLSI Design and Technology))

23A41702a	**VLSI PHYSICAL DESIGN** **(PROFESSIONAL ELECTIVE V)**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the key stages and challenges involved in physical design automation of VLSI circuits.
2. To study various partitioning, floor planning, and placement techniques in the design flow.
3. To explore global and detailed routing algorithms and clock network synthesis.
4. To learn the principles of timing analysis, timing closure, and layout optimization.
5. To analyze interconnect modeling, layout compaction, and performance-driven design strategies.

Course Outcomes:

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

1. Understand the key stages and challenges involved in physical design automation of VLSI circuits.
2. Learn various partitioning, floor planning, and placement techniques in the design flow.
3. Explore global and detailed routing algorithms and clock network synthesis.
4. Grasp the principles of timing analysis, timing closure, and layout optimization.
5. Analyze interconnect modeling, layout compaction, and performance-driven design strategies.

UNIT 1: Introduction to physical design automation, Partitioning, Floor planning and Placement.

UNIT 2: Grid Routing and Global Routing, Detailed Routing and Clock Design

UNIT 3: Clock Routing and Power/Ground, Static Timing Analysis and Timing Closure

UNIT 4: Physical Synthesis and Performance Driven Design Flow, Interconnect Modelling and Layout Compaction

UNIT 5: Introduction to Testing, Fault Modelling and Simulation Week 10: Test Pattern Generation, DFT and BIST, Low Power Design Techniques.

Text Books:

1. Naveed A. Sherwani, "Algorithms for VLSI Physical Design Automation", Publisher: Springer.

2. KhosrowGolshan, "Physical Design Essentials: An ASIC Design Implementation Perspective", Publisher: Springer.

3. Sadiq M. Sait, Habib Youssef, "VLSI Physical Design Automation: Theory and Practice", Publisher: World Scientific.

Reference Books:

1. Wayne Wolf, "Modern VLSI Design: IP-Based Design", Publisher: Pearson.

2. Neil H.E. Weste and David Harris,"CMOS VLSI Design: A Circuits and Systems Perspective", Publisher: Pearson.

IVB.Tech I Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04605a	**DIGITAL IMAGE PROCESSING**	3	0	0	3

Course Objectives:

1. To learn the fundamentals of Image Processing with different Transforms.
2. To understand functions of Intensity Transformations and working fundamentals of Spatial Filters
3. Toimplementvarious models of Restoring and Reconstruction of Images from filtering projections.
4. To study the concepts of image compression using different coding &Wavelets and Multiresolution Processes.
5. To design image processing systems using Segmentation techniques for Morphological & Color Images.

Course Outcomes:

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

1. Learn the fundamentals of Image Processing with different Transforms.
2. Uunderstand functions of Intensity Transformations and working fundamentals of Spatial Filters
3. Iimplement various models of Restoring and Reconstruction of Images from filtering projections.
4. Grasp the concepts of image compression using different coding &Wavelets and Multiresolution Processes.
5. Design the image processing systems using Segmentation techniques for Morphological & Color Images.

UNIT I

Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. Image Transforms: Need for image transforms, Discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD and Radon Transform, Comparison of different image transforms.

UNIT II

Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters , sharpening spatial filters, Combining spatial enhancement methods Filtering in the Frequency Domain: Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.

UNIT III

Image Restoration and Reconstruction: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter ,image reconstruction from projections.

UNIT IV

Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding Wavelets and Multiresolution Processing: Image pyramids, subband coding, Multiresolution expansions, wavelet transforms in one dimensions & two dimensions, Wavelet coding.

UNIT V

Image segmentation: Fundamentals, point, line, edge detection, thresholding, region –based segmentation. Morphological Image Processing: Preliminaries, Erosion and dilation, opening and closing, basic morphological algorithms for boundary extraction, thinning, gray-scale morphology, Segmentation using morphological watersheds.

Color image processing: color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

Textbooks:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar," Digital Image Processing", Tata McGraw-Hill Education, 2011.

Reference Books:

1. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 9th Edition, Indian Reprint, 2002.
2. B.Chanda, D.DuttaMajumder, "Digital Image Processing and Analysis", PHI, 2009

Online Learning Resources:

https://nptel.ac.in/courses/117105079

https://nptel.ac.in/courses/117105135

IVB.Tech I Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A41702b	**DIGITAL DESIGN WITH VERILOG**	3	0	0	3

Course Objectives:

1. To introduce Verilog as a hardware description language and its role in digital design.
2. To provide knowledge of different modeling styles—gate level, dataflow, behavioral, and switch level.
3. To develop the ability to write and simulate Verilog modules using various constructs and operators.
4. To learn the use of system tasks, functions, compiler directives, and user-defined primitives.
5. To enable understanding of the synthesis and simulation flow from Verilog code to gate-level netlists.

Course Outcomes:

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

1. Understand Verilog as a hardware description language and its role in digital design.
2. Gain knowledge on different modelling styles.
3. Write and simulate Verilog modules using various constructs and operators.
4. Learn the use of system tasks, functions, compiler directives, and user-defined primitives.
5. Get familiar with the synthesis and simulation flow from Verilog code to gate-level netlists.

UNIT-1:

Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Programming Language Interface, Module. Language Constructs and Conventions: Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Data Types, Scalars and Vectors, Operators.

UNIT-2:

Gate Level Modeling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Gate Delay, Strengths and Contention Resolution, Net Types. Modeling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators.

UNIT -3:

Behavioral Modeling: Introduction, Operations and Assignments, 'Initial' Construct, Always construct, Assignments with Delays, 'Wait ‘Construct, Design at Behavioral Level, Blocking and Non-Blocking Assignments, The 'Case' Statement, 'If' and 'if-Else' Constructs, 'Assign- De-

Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, sequential and Parallel Blocks.

UNIT-4:

Switch Level Modeling: Basic Transistor Switches, CMOS Switches, Bidirectional Gates, Time Delays with Switch Primitives, instantiation with strengths and delays, Switch level modeling for NAND, NOR and XOR.

UNIT-5:

System Tasks, Functions and Compiler Directives: Parameters, Path Delays, Module Parameters, System Tasks and Functions, User Defined Primitives, Compiler directives.

Text Books:

1. T.R. Padmanabhan, B Bala Tripura Sundari, Design Through Verilog HDL, Wiley 2009.
2. Samir Palnitkar, “Verilog HDL” - 2nd Edition, Pearson Education, 2009.

Reference Books:

1. Stephen Brown,ZvonkocVranesic, “Fundamentals of Digital Logic with Verilog Design” - TMH, 2nd Edition.
2. ZainalabdienNavabi, “Verliog Digital System Design”, TMH, 2nd Edition.
3. Sunggu Lee, “Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA”, Cengage Learning, 2012.
4. Michel D. Ciletti, “Advanced Digital Design with Verilog HDL”, PHI, 2009.

IVB.Tech I Semester (EE (VLSI Design and Technology))

		L	T	P	C
23A04705a	**RF SYSTEM DESIGN TOOLS** **Skill Oriented Course**	0	1	2	2

Course Objectives:

1. To introduce RF design software and tools for designing and simulating RF systems.
2. To understand impedance matching techniques and the role of scattering parameters in RF circuit design.
3. To explore the design of RF power amplifiers, filters, oscillators, mixers, and voltage-controlled oscillators (VCOs).
4. To analyze microstrip transmission lines, their discontinuities, and their applications in RF systems.
5. To study the design, simulation, and measurement of antennas and microwave integrated circuits.

Course Outcomes:

After completing the course, the student will be able to,

1. Utilize RF design software and tools to simulate and analyze RF circuits and components.
2. Design and implement impedance matching networks such as L-match, Pi-match, and T-match circuits.
3. Develop and evaluate RF amplifiers, filters, oscillators, and mixers for high-frequency applications.
4. Analyze microstrip transmission lines and measure their characteristics using S-parameters and Smith charts.
5. Design and simulate various types of antennas, including microstrip patch antennas, Yagi-Uda antennas, and horn antennas.

Basic Concepts in RF Design: Introduce any RF design software and orient students with the tools of the laboratory. Practice the tool to use it for significant design. Introduction to RF Design, Time Variance and Nonlinearity, Effects of nonlinearity, Passive impedance transformation, Scattering parameters, impedance matching, L match,Pi match, T match, Passive IC Components-Resistors, capacitors Inductors, Schottky Diode, RF Switch.

RF Power Amplifiers and Filters: RF Power amplifier design examples, Gain equalizers, Voltage controlled oscillators, Phase locked loops, Linearized PLL models, PLL design examples, High frequency oscillators, Loop filters, lumped filter. LPF, HPF and BPF.

LNA, VCO and Mixers: General considerations, Problem of input matching, Low Noise Amplifiers design in various topologies, Gain Switching, Band Switching, Voltage Controlled

Oscillators, Mixers-General considerations, Passive down conversion mixers, Active down conversion mixers, Up conversion mixers.

Microstrip transmission lines and discontinuities: S parameters of a Microstrip Transmission Line, Smith Chart, Analysis of Microstrip Transmission Line standing wave patterns at various frequencies, Different types of Transmission lines like CPW, Microstrip and Co-axial cable. Different types of Microstrip discontinuities like Bend, T, Via, Gap etc., Microstrip Ring Resonator.

Antennas and Microwave Integrated Circuits: Radiation Pattern, Gain, S Parameters, Return loss and VSWR. Design considerations of Microstrip Patch Antenna and Microstrip Array, Yagi Uda Antenna and Horn Antenna. Hybrid Microwave Integrated Circuits, Monolithic Microwave Integrated Circuits, Microwave Integrated Circuits: MMIC Amplifier.

Any twelve experiments are to be done:

1. Design and simulate Impedance matching circuits like L-Matching, Pi Matching and T-Matching.
2. Design and Simulate a Schottky Diode and RF Switch.
3. Design and simulate a RF BJT Amplifier and LNA.
4. Design and simulate a Power Amplifier and Gain Equalizer.
5. Analyse and measure the gain of a Power Amplifier and equalise its gain using an Equalizer.
6. Design and simulate a High Frequency Oscillator and Lumped Filter.
7. Measurement of insertion loss, -3dB Cut of frequency of LPF,HPF and BPF.
8. Design and Simulate a VCO and RF Mixer.
9. Measure the S parameters of a Micro strip Transmission Line and plot the normalised impedance on a smith chart
10. Analysis of Microstrip Transmission Line standing wave pattern at various frequencies.
11. Study of different types of Transmission lines like CPW, Microstrip and Co-axial and find/measure its Insertion Loss (S21 and S12)
12. Study of different types of Microstrip discontinuities like Bend, T, Via , Gap etc and find/measure its Insertion loss.
13. Determine the Bandwidth and Quality Factor of a Microstrip Ring Resonator.
14. Design and simulate the Radiation Pattern,gain, $S_{11}$and VSWRof a Microstrip Patch Antenna and Microstrip Array.
15. Design and simulate the Radiation Pattern, gain, $S_{11}$and VSWR of a Yagi Uda Antenna and Horn Antenna.
16. Design and Simulate a MMIC Amplifier.

Equipment Required

1. RF Circuit Design and Simulation Software
2. RF Training System

3.Antenna Measurement System with Antenna Design Software.

IVB.Tech I Semester (EE (VLSI Design and Technology))

23A04705b	**INDUSTRIAL IOT AND AUTOMATION (SEC –V) (SKILL COURSE)**	**L**	**T**	**P**	**C**
		0	1	2	2

Course Objectives:

1. To introduce the fundamentals of Industrial IoT (IIoT), its architecture, and its differences from traditional IoT.
2. To understand the components of IIoT, including sensors, actuators, and control systems, and their integration with embedded platforms.
3. To explore communication technologies such as ZigBee, Bluetooth, NFC, RFID, and MQTT for IIoT applications.
4. To study data visualization techniques, dashboard creation, and web-based connectivity for IIoT systems.
5. To learn data retrieval techniques, machine-to-machine (M2M) communication, and cloud integration for IIoT applications.
6. To implement automation using PLCs, SCADA, and real-time control systems for industrial applications.

Course Outcomes:

After completing the course, the student will be able to,

1. Explain the fundamental concepts of IIoT, its architecture, and the challenges associated with industrial automation.
2. Demonstrate the integration of sensors and actuators with Raspberry Pi/NodeMCU for real-time monitoring and control.
3. Implement communication protocols such as MQTT, ZigBee, and Bluetooth to enable seamless IIoT connectivity.
4. Develop web-based dashboards for real-time visualization and remote monitoring of IIoT devices.
5. Retrieve, analyze, and transmit industrial data using web-based interactions and M2M communication.
6. Implement PLC-based automation, ladder logic programming, and SCADA for supervisory control in industrial environments.

(All the modules need to be conducted and minimum one project to be done)

MODULE 1: Introduction & Architecture

What is IIoT and connected world? The difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT. Practice

1. Introduction to Arduino, Introduction to raspberry Pi.

https://www.youtube.com/watch?v=AQdLQV6vhbk

MODULE 2: IIOT Components

Fundamentals of Control System, introductions, components, closed loop & open loop system.

Introduction to Sensors (Description and Working principle): What is sensor? Types of sensors, working principle of basicSensors -Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11).Digital switch, Electro Mechanical switches.

Practice

1. Measurement of temperature & pressure values of the process using raspberry pi/node mcu.

2. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu.

3. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberry pi/node mcu.

MODULE 3: Communication Technologies of IIoT

Communication Protocols: IEEE 802.15.4, ZigBee, Bluetooth, BLE, NFC, RFIDIndustry standards communication technology (MQTT), wireless network communication.

Practice

1. Demonstration of MQTT communication.

MODULE 4: Visualization and Data Types of IIoT

Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.

Practice

1. Visualization of diverse sensor data using dashboard (part of IoT's 'control panel')

2. Sending alert message to the user. ways to control and interact with your environment)

MODULE 5: Retrieving Data

Extraction from Web: Grabbing the content from a web page, Sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M).

Practice

1. Device control using mobile Apps or through Web pages.

2. Machine to Machine communication.

MODULE 6: Control & Supervisory Level of Automation

Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA).

Practice

1. Digital logic gates programming using ladder diagram.
2. Implementation of Boolean expression using ladder diagram.
3. Simulation of PLC to understand the process control concept.

Projects:

IIoT based smart energy meter

Smart Agriculture system

Automation using controller via Bluetooth

Temperature controlled Fan/cooler using controller

Automatic streetlight

Smart Baggage Tracker

Textbooks

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
2. Industrial Internet of Things: Cybermanufacturing System**,** Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication)
3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)

IVB.Tech I Semester (EE (VLSI Design and Technology))

23A52702	**GENDER SENSITIZATION** **(Common to All Branches of Engineering)**	**L**	**T**	**P**	**C**
		0	0	2	0

Course Objectives:

- To enable students to understand the gender related issues, vulnerability of women and men
- To familiarize them about constitutional safeguard for gender equality
- To expose the students to debates on the politics and economics of work
- To help students reflect critically on gender violence
- To make them understand that gender identities and gender relations are part of culture as they shape the way daily life is lived in the family as well as wider community and the workplace.

Course Outcomes (CO):

COs	**Statements**	**Blooms level**
CO1	Understand the basic concepts of gender and its related terminology	L1, L2,
CO2	Identify the biological, sociological, psychological and legal aspects of gender.	L1, L2
CO3	Use the knowledge in understanding how gender discrimination works in our society and how to counter it.	L3
CO4	Analyzethe gendered division of labour and its relation to politics and economics.	L4
CO5	Appraise how gender-role beliefs and sharing behaviour are associated with more well-being in all culture and gender groups	L5
CO6	Develop students' sensibility with regard to issues of gender in contemporary India	L3

Unit-1 UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

Unit-2 GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles- Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio- Demographic Consequences-Gender Spectrum -

Unit-3 GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- "My Mother doesn't Work." "Share the Load."-Work: Its Politics and Economics -Fact and Fiction- Unrecognized and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable Development-Gender and Human Rights-Gender and Mainstreaming

Unit-4 GENDER-BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

Unit-5 GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships

Prescribed Books

1. A.Suneetha, Uma Bhrugubanda, et al. *Towards a World of Equals: A Bilingual Textbook on Gender*", Telugu Akademi, Telangana, 2015.
2. Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity*. UK Paperback Edn. March 1990

Reference Books

1. Wtatt, Robin and Massood, Nazia, *Broken Mirrors: The dowry Problems in India,*London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), *Women in Developing Countries, Assessing Strategies for Empowerment*, London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., *Gender and Governance*, New Delhi, Rawat Publication, 2007
4. Singh, Direeti, *Women and Politics World Wide*, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, *Gender Sensitization: Issues and Challenges* (English, Hardcover), Raj Publications, 2019
6. A.Revathy& Murali, Nandini, *A Life in Trans Activism*(Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

Online Resources:

1. Understanding Gender

chrome-extension://kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf

https://onlinecourses.swayam2.ac.in/nou24_hs53/preview

2. Gender Roles and Relations

https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes

https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408

https://onlinecourses.swayam2.ac.in/cec23_hs29/preview

3. Gender and Labour

https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed

https://onlinecourses.nptel.ac.in/noc23_mg67/preview

4. **GENDER-BASED VIOLENCE**

https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en

https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls

https://onlinecourses.swayam2.ac.in/nou25_ge38/preview

5. **GENDER AND CULTURE**

https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/

https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/

https://archive.nptel.ac.in/courses/109/106/109106136/

Abdulali Sohaila. “I Fought For My Life…and Won.”Available online (at: http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdulal/

OPEN ELECTIVES

III B.Tech I Semester

Course Code	**GREEN BUILDINGS (OPEN ELECTIVE - I)**	L	T	P	C
23A01505a		3	0	0	3

Course Objectives :

The objectives of this course are to make the student:

1. **To understand** the fundamental concepts of green buildings, their necessity, and sustainable features.
2. **To analyze** green building concepts, rating systems, and their benefits in India.
3. **To apply** green building design principles, energy efficiency measures, and renewable energy sources.
4. **To evaluate** air conditioning systems, HVAC designs, and energy modeling for sustainable buildings.
5. **To assess** material conservation strategies, waste management, and indoor environmental quality in green buildings.

Course Outcomes (COs)

Upon successful completion of the course, students will be able to:

1. **Understand** the importance of green buildings, their necessity, and sustainable features.
2. **Analyze** various green building practices, rating systems, and their impact on environmental sustainability.
3. **Apply** principles of green building design to enhance energy efficiency and incorporate renewable energy sources.
4. **Evaluate** HVAC systems, energy-efficient air conditioning techniques, and their role in sustainable building design.
5. **Assess** material conservation techniques, waste reduction strategies, and indoor air quality management in green buildings.

CO - PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	-	2	3	-	-	-	-	-	3	3
CO -2	-	3	-	-	2	-	3	-	-	-	-	2	3	3
CO -3	-	-	3	3	3	-	3	-	-	-	-	-	3	3
CO -4	-	-	3	3	3	-	3	-	-	-	-	-	3	3

CO -5	-	-	-	-	-	3	3	3	2	-	-	-	-	3

UNIT – I		

Introduction to Green Building– Necessity of Green Buildings, Benefits of Green Buildings, Green Building Materials and Equipment in India, Key Requisites for Constructing A Green Building, Important Sustainable Features for Green Buildings.

UNIT – II		

Green Building Concepts and Practices– Indian Green Building Council, Green Building Movement in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities and Benefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy-Saving Approaches in Buildings, LEED India Rating System, and Energy Efficiency.

UNIT – III		

Green Building Design– Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximizing System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT – IV		

Air Conditioning– Introduction, CII Godrej Green Business Centre, Design Philosophy, Design Interventions, Energy Modeling, HVAC System Design, Chiller Selection, Pump Selection, Selection of Cooling towers, Selection of Air Handling Units, Pre-Cooling of Fresh Air, Interior Lighting Systems, Key Features of The Building, Eco-Friendly Captive Power Generation for Factories, Building Requirements.

UNIT – V		

Material Conservation– Handling of Non-Process Waste, Waste Reduction During Construction, Materials With Recycled Content, Local Materials, Material Reuse, Certified Wood, Rapidly Renewable Building Materials and Furniture. Indoor Environment Quality and Occupational Health– Air Conditioning, Indoor Air Quality, Sick Building Syndrome, tobacco Smoke.

TEXT BOOKS:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by tom woolley and Sam kimings, 2009.

REFRENCE BOOKS:

1. Complete Guide to Green Buildings by Trish riley
2. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009
3. Energy Conservation Building Code –ECBC-2020, published by BEE

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/102/105102195/

III B.Tech – I Semester

Course Code	**CONSTRUCTION TECHNOLOGY AND MANAGEMENT (OPEN ELECTIVE – I)**	L	T	P	C
23A01505b		3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand project management fundamentals, organizational structures, and leadership principles in construction.
2. To analyze manpower planning, equipment management, and cost estimation in civil engineering projects.
3. To apply planning, scheduling, and project management techniques such as CPM and PERT.
4. To evaluate various contract types, contract formation, and legal aspectsin construction management.
5. To assess safety management practices, accident prevention strategies, and quality management systems in construction.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

1. Understand (Cos)project management fundamentals, organizational structures, and leadership principles in construction.
2. Analyze manpower planning, equipment management, and cost estimationin civil engineering projects.
3. Apply planning, scheduling, and project management techniques such as CPM and PERT.
4. Evaluate various contract types, contract formation, and legal aspectsin construction management.
5. Assess safety management practices, accident prevention strategies, and quality management systems in construction.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	-	2	-	2	2	-	-	-	3	3
CO -2	-	3	-	-	2	-	-	-	-	-	-	2	3	3
CO -3	-	-	3	3	3	-	-	-	-	2	-	-	3	3
CO -4	-	-	3	3	3	-	-	2	-	-	-	-	3	3
CO -5	-	-	-	-	-	3	3	3	2	-	-	-	-	3

UNIT – I		
Introduction: Project forms, Management Objectives and Functions; Organizational Chart of A Construction Company; Manager's Duties and Responsibilities; Public Relations; Leadership and Team - Work; Ethics, Morale, Delegation and Accountability.		
UNIT – II		
Man and Machine: Man-Power Planning, Training, Recruitment, Motivation, Welfare Measures and Safety Laws; Machinery for Civil Engineering., Earth Movers and Hauling Costs, Factors Affecting Purchase, Rent, and Lease of Equipment, and Cost Benefit Estimation.		
UNIT – III		
Planning, Scheduling and Project Management: Planning Stages, Construction Schedules and Project Specification, Monitoring and Evaluation; Bar-Chart, CPM, PERT, Network-formulation and Time Computation.		
UNIT – IV		
Contracts: Types of Contracts, formation of Contract – Contract Conditions – Contract for Labour, Material, Design, Construction – Drafting of Contract Documents Based On IBRD/ MORTH Standard Bidding Documents – Construction Contracts – Contract Problems – Arbitration and Legal Requirements Computer Applications in Construction Management: Software for Project Planning, Scheduling and Control.		
UNIT – V		
Safety Management – Implementation and Application of QMS in Safety Programs, ISO 9000 Series, Accident Theories, Cost of Accidents, Problem Areas in Construction Safety, Fall Protection, Incentives, Zero Accident Concepts, Planning for Safety, Occupational Health and Ergonomics.		
TEXT BOOKS:		
1. Construction Project Management, SK. Sears, GA. Sears, RH. Clough, John Wiley and Sons, 6th Edition, 2016. 2. Construction Project Scheduling and Control by Saleh Mubarak, 4th Edition, 2019 3. Pandey, I.M (2021) Financial Management 12th edition. Pearson India Education Services Pvt. Ltd.		
REFRENCE BOOKS:		
1. Brien, J.O. andPlotnick, F.L., CPMin Construction Management, Mcgraw Hill, 2010. 2. Punmia, B.C., andKhandelwal, K.K., Project Planning and control with PERT and CPM, Laxmi Publications, 2002. 3. Construction Methods and Management: Pearson New International Edition 8 th Edition Stephens Nunnally. 4. Rhoden, M and Cato B, Construction Management andOrganisational Behaviour, Wiley-		

Blackwell, 2016.
Online Learning Resources:
https://archive.nptel.ac.in/courses/105/104/105104161/ **https://archive.nptel.ac.in/courses/105/103/105103093/**

III B.Tech I Semester

23A02505	**ELECTRICAL SAFETY PRACTICES AND STANDARDS (Open Elective-I)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Outcomes:

CO1: Understanding the Fundamentals of Electrical Safety -L2

CO2: Identifying and Applying Safety Components -L3

CO3: Analyzing Grounding Practices and Electrical Bonding

CO4: Applying Safety Practices in Electrical Installations and Environments- L4

CO5: Evaluating Electrical Safety Standards and Regulatory Compliance -L5

UNIT I

Introduction To Electrical Safety:

Fundamentals of Electrical safety-Electric Shock- physiological effects of electric current - Safety requirements –Hazards of electricity- Arc - Blast- Causes for electrical failure.

UNIT II

Safety Components:

Introduction to conductors and insulators- voltage classification -safety against over voltages- safety against static electricity-Electrical safety equipment's - Fire extinguishers for electrical safety.

UNIT III

Grounding:

General requirements for grounding and bonding- Definitions- System grounding- Equipment grounding - The Earth - Earthing practices- Determining safe approach distance-Determining arc hazard category.

UNIT IV

Safety Practices:

General first aid- Safety in handling hand held electrical appliances tools- Electrical safety in train stations-swimming pools, external lighting installations, medical locations- Case studies.

UNIT V

Standards For Electrical Safety:

Electricity Acts- Rules & regulations- Electrical standards-NFPA 70 E-OSHA standards-IEEE standards-National Electrical Code 2005 – National Electric Safety code NESC-Statutory requirements from electrical inspectorate

TEXT BOOKS:

1. Massimo A.G.Mitolo, "Electrical Safety of Low-Voltage Systems", McGraw Hill, USA, 2009.
2. Mohamed El-Sharkawi, "Electric Safety - Practice and Standards", CRC Press, USA, 2014

REFERENCES:

1. Kenneth G.Mastrullo, Ray A. Jones, "The Electrical Safety Program Book", Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman, "Electrical Safety-Related Work Practices", Jones & Bartlett Publishers, London, 2009.
3. Fordham Cooper, W., "Electrical Safety Engineering", Butterworth and Company, London, 1986.
4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel, "Electrical Safety Hand book, McGraw-Hill, New York, USA, 4th edition, 2012.

B. TECH-ME-III-I Sem

23A03505	SUSTAINBLE ENERGY TECHNOLOGIES (Open Elective-I)	L	T	P	C
		3	0	0	3

Course objectives: The objectives of the course are to	
1	To demonstrate the importance the impact of solar radiation, solar PVmodules
2	To understand the principles of storage in PV systems
3	To discuss solar energy storage systems and their applications.
4	To get knowledge in wind energy and bio-mass
5	To gain insights in geothermal energy, ocean energy and fuel cells.

COURSE OUTCOMES On successful completion of this course the student will be able to		
CO1	Illustrate the importance of solar radiation and solar PV modules.	L1, L2
CO2	Discuss the storage methods in PV systems	L2,L3
CO3	Explain the solar energy storage for different applications	L2,L3
CO4	Understand the principles of wind energy, and bio-mass energy.	L2, L3
CO5	Attain knowledge in geothermal energy, ocean energy and fuel cells.	L1, L2,L3, L4

UNIT – 1

SOLAR RADIATION: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems.

SOLAR PV MODULES AND PV SYSTEMS:

PV Module Circuit Design, Module Structure, Packing Density, Interconnections, Mismatch and Temperature Effects, Electrical and Mechanical Insulation, Lifetime of PV Modules, Degradation and Failure, PV Module Parameters, Efficiency of PV Module, Solar PV Systems-Design of Off Grid Solar Power Plant. Installation and Maintenance.

UNIT – 2
STORAGE IN PV SYSTEMS:
Battery Operation, Types of Batteries, Battery Parameters, Application and Selection of Batteries for Solar PV System, Battery Maintenance and Measurements, Battery Installation for PV System.

UNIT – 3
SOLAR ENERGY COLLECTION: Flat plate and concentrating collectors, classification of concentrating collectors, orientation.

SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney.

UNIT – 4
WIND ENERGY: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement.

BIO-MASS: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.

UNIT – 5
GEOTHERMAL ENERGY: Origin, Applications, Types of Geothermal Resources, Relative Merits.

OCEAN ENERGY: Ocean Thermal Energy; Open Cycle & Closed Cycle OTEC Plants, Environmental Impacts, Challenges.

FUEL CELLS: Introduction, Applications, Classification, Different Types of Fuel Cells Such as Phosphoric Acid Fuel Cell, Alkaline Fuel Cell, PEM Fuel Cell, MC Fuel Cell.

Text Books:

1. Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH

2. Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006

References:

1. Principles of Solar Engineering - D.Yogi Goswami, Frank Krieth& John F Kreider / Taylor & Francis

2. Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd

3. Renewable Energy Technologies -Ramesh & Kumar /Narosa

4. Non-conventional Energy Source- G.D Roy/Standard Publishers

Online Learning Resources:

https://nptel.ac.in/courses/112106318

https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=-mwIa2X-SuSiNy13

https://youtube.com/playlist?list=PLyqSpQzTE6M-ZgdjYukayF6QevPv7WE-r&si=Apfjx6oDfz1Rb_N3

https://youtu.be/zx04Kl8y4dE?si=VmOvp_OgqisILTAF

III B.Tech I Sem

23A05506a	JAVA PROGRAMMING (Open Elective-I)	L	T	P	C
		3	0	0	3

Course Objectives: The main objective of the course is to Identify Java language components and how they work together in applications

- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception
- handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java apisfor program development

Course Outcomes: After completion of the course, students will be able to

CO1: Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.

CO2: Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects

CO3: Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.

CO4: Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.

CO5: Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.

Unit – I: Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style. Data Types, **Variables, and Operators :**Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, **Introduction to Operators**, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?:, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

Unit II:Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Methods, Access Control, Recursive Methods, Nesting of Methods, Overriding Methods, Attributes Final and Static.

Unit III: Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors. **Inheritance:** Introduction, Process of Inheritance, Types of Inheritances, Universal Super ClassObject Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

Unit IV: Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Autounboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

Unit V: String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings,Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread Creation of New Threads, Thread States, Thread Priority-Synchronization, Deadlock and Race Situations, Inter thread Communication - Suspending, Resuming, and Stopping of Threads. Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Learning Resources:

Textbooks:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH

2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Learning Resources:

1. *https://nptel.ac.in/courses/106/105/106105191/*
2. *https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347 _shared/overv*iew

III B.Tech I Sem

23A05506b	**FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE (Open Elective-I)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To learn the distinction between optimal reasoning Vs. human like reasoning.
- To understand the concepts of state space representation, exhaustive search, heuristic
- search together with the time and space complexities.
- To learn different knowledge representation techniques.
- To understand the applications of AI, namely game playing, theorem proving, and machine learning.

Course Outcomes:

- Learn the distinction between optimal reasoning Vs human like reasoning and formulate an efficient problem space for a problem expressed in natural language. Also select a search algorithm for a problem and estimate its time and space complexities.
- Apply AI techniques to solve problems of game playing, theorem proving, and machine learning.
- Learn different knowledge representation techniques.
- Understand the concepts of state space representation, exhaustive search, heuristic search together with the time and space complexities.
- Comprehend the applications of Probabilistic Reasoning and Bayesian Networks.
- Analyze Supervised Learning Vs. Learning Decision Trees

UNIT - I

Introduction to AI - Intelligent Agents, Problem-Solving Agents,

Searching for Solutions - Breadth-first search, Depth-first search, Hill-climbing search, Simulated annealing search, Local Search in Continuous Spaces.

UNIT-II

Games - Optimal Decisions in Games, Alpha–Beta Pruning, Defining Constraint Satisfaction Problems, Constraint Propagation, Backtracking Search for CSPs, Knowledge-Based Agents, **Logic-** Propositional Logic, Propositional Theorem Proving: Inference and proofs, Proof by resolution, Horn clauses and definite clauses.

UNIT-III

First-Order Logic - Syntax and Semantics of First-Order Logic, Using First Order Logic, Knowledge Engineering in First-Order Logic. Inference in First-Order Logic: Propositional vs. First-Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.

Knowledge Representation: Ontological Engineering, Categories and Objects, Events.

UNIT-IV

Planning - Definition of Classical Planning, Algorithms for Planning with State Space Search, Planning Graphs, other Classical Planning Approaches, Analysis of Planning approaches. Hierarchical Planning.

UNIT-V

ProbabilisticReasoning:

Acting under Uncertainty, Basic Probability Notation Bayes' Rule and Its Use, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Approximate Inference in Bayesian Networks, Relational and First- Order Probability.

TEXT BOOK:

1. Artificial Intelligence: A Modern Approach, Third Edition, Stuart Russell and Peter Norvig, Pearson Education.

REFERENCE BOOKS:

1. Artificial Intelligence, 3rd Edn., E. Rich and K. Knight (TMH)
2. Artificial Intelligence, 3rd Edn., Patrick Henny Winston, Pearson Education.
3. Artificial Intelligence, Shivani Goel, Pearson Education.
4. Artificial Intelligence and Expert systems – Patterson, Pearson Education.

III B.Tech I Sem

23A05506c	**QUANTUM TECHNOLOGIES AND APPLICATIONS** **Open Elective – I**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:
• To introduce the fundamentals of quantum mechanics relevant to quantum technologies.
• To explain key quantum phenomena and their role in enabling novel technologies.
• To explore applications in quantum computing, communication, and sensing.
• To encourage understanding of emerging quantum-based technologies and innovations.
Syllabus
UNIT I: Fundamentals of Quantum Mechanics (7 Hours)
• Classical vs Quantum Paradigm
• Postulates of Quantum Mechanics
• Wavefunction and Schrödinger Equation (Time-independent)
• Quantum states, Superposition, Qubits
• Measurement, Operators, and Observables
• Entanglement and Non-locality
UNIT II: Quantum Computing
• Qubits and Bloch Sphere
• Quantum Logic Gates: Pauli, Hadamard, CNOT, and Universal Gates
• Quantum Circuits
• Basic Algorithms: Deutsch-Jozsa. Gover's, Shor's (conceptual)
• Error Correction and Decoherence
UNIT III: Quantum Communication and Cryptography (7 Hours)
• Teleportation & No-Cloning
• BB84 Protocol
• Quantum Networks & Repeaters
• Classical vs Quantum Cryptography
• Challenges in Implementation
UNIT IV: Quantum Sensors and Metrology
• Quantum Sensing: Principles and Technologies
• Quantum-enhanced Measurements
• Atomic Clocks, Gravimeters
• Magnetometers, NV Centers
• Industrial Applications
UNIT V: Quantum Materials and Emerging Technologies
• Quantum Materials: Superconductors, Topological Insulators
• Quantum Devices: Qubits, Josephson Junctions
• National Quantum Missions (India, EU, USA, China)
• Quantum Careers and Industry Initiatives

Textbooks and References
Primary Textbooks:
• "Quantum Computation and Quantum Information" by Michael A. Nielsen and Isaac L. Chuang (Cambridge University Press)
• "Quantum Mechanics: The Theoretical Minimum" by Leonard Susskind and Art Friedman (Basic Books)
Supplementary Reading:
• "Quantum Computing for Everyone" by Chris Bernhardt (MIT Press)
• "Quantum Physics: A Beginner's Guide" by Alastair I.M. Rae
• "An Introduction to Quantum Computing" by Phillip Kaye, Raymond Laflamme, and Michele Mosca
• IBM Quantum Experience and Qiskit Documentation (https://qiskit.org/)
Course Outcomes
• Understand key quantum mechanical concepts and phenomena.
• Comprehend the structure and function of quantum algorithms and circuits.
• Explore applications in quantum communication and cryptography.
• Appreciate the role of quantum technologies in modern engineering systems.

III B.Tech I Sem

23A54501	**MATHEMATICS FOR MACHINE LEARNING AND AI (Open Elective 1)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To provide a strong mathematical foundation for understanding and developing AI/ML algorithms.
- To enhance the ability to apply linear algebra, probability, and calculus in AI/ML models.
- To equip students with optimization techniques and graph-based methods used in AI applications.
- To develop critical problem-solving skills for analysing mathematical formulations in AI/ML.

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	**Statements**	**Blooms level**
CO1	Apply linear algebra concepts to ML techniques like PCA and regression.	L3 (Apply)
CO2	Analyze probabilistic models and statistical methods for AI applications.	L4 (Analyze)
CO3	Implement optimization techniques for machine learning algorithms.	L3 (Apply)
CO4	Utilize vector calculus and transformations in AI-based models.	L3 (Apply)
CO5	Develop graph-based AI models using mathematical representations.	L5 (Evaluate)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	2	3	2	-	-	-	-	-	-	2
CO3	3	3	3	3	2	1	-	-	-	-	-	2
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	3	3	2	-	-	-	-	-	-	2

• **3** = Strong Mapping, **2** = Moderate Mapping, **1** = Slight Mapping, **-** = No Mapping

UNIT I: Linear Algebra for Machine Learning(08)

Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigenvalues, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

UNIT II: Probability and Statistics for AI(08)

Probability distributions: Gaussian, Binomial, Poisson. Bayes' Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP).Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.

UNIT III: Optimization Techniques for ML(08)

Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions.Gradient Descent and its variants (Momentum, Adam) Newton's method, BFGS method.

UNIT IV: Vector Calculus & Transformations(08)

Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

UNIT V: Graph Theory for AI(08)

Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

Textbooks:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.

2. Pattern Recognition and Machine Learningby Christopher Bishop, Springer.

Reference Books:

1. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.
2. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.

Web References:

- MIT– Mathematics for Machine Learning https://ocw.mit.edu
- Stanford CS229 – Machine Learning Course https://cs229.stanford.edu/

DeepAI – Mathematical Foundations for AI https://deepai.org

III B.Tech I Sem

23A56501	**MATERIALS CHARACTERIZATION TECHNIQUES** (Common to all branches) (Open Elective-Interdisciplinary) **(Open Elective-I)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES	
1	To provide exposure to different characterization techniques.
2	To explain the basic principles and analysis of different spectroscopic techniques.
3	To elucidate the working of Scanning electron microscope - Principle, limitations and applications.
4	To illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications.
5	To educate the uses of advanced electric and magnetic instruments for characterization.

UNIT I Structure analysis by Powder X-Ray Diffraction 9H

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT II Microscopy technique -1 –Scanning Electron Microscopy (SEM) 9H

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT III Microscopy Technique -2 - Transmission Electron Microscopy (TEM) 9H

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy

UNIT IV Spectroscopy techniques 9H

Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT V Electrical & Magnetic Characterization techniques 9H

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Textbooks:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2013.
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville BanwellandElaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity& Stuart R Stocks, Prentice Hall , 2001 – Science.
3. Practical Guide to Materials Characterization: Techniques and Applications - Khalid Sultan – Wiley – 2021.
4. **Materials Characterization Techniques -**Sam Zhang, Lin Li, Ashok Kumar -CRC Press - 2008

NPTEL courses link :

1. **https://nptel.ac.in/courses/115/103/115103030/**
2. **https://nptel.ac.in/content/syllabus_pdf/113106034.pdf**
3. **https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/**

	Course Outcomes	**Blooms Level**
CO1	Analyze the crystal structure and crystallite size by various methods	L1,L2, L3, L4
CO2	Analyze the morphology of the sample by using a Scanning Electron Microscope	L1,L2, L4
CO3	Analyze the morphology and crystal structure of the sample by using Transmission Electron Microscope	L1,L2, L3

CO4	Explain the principle and experimental arrangement of various spectroscopic techniques	L1,L2
CO5	Identify the construction and working principle of various Electrical & Magnetic Characterization technique	L1,L2

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1							
CO2	3	3	2	1	1							
CO3	3	3	2	1	1							
CO4	3	2	1	1	-							
CO5	3	3	1	1	-							

1-Slightly, 2-Moderately, 3-Substantially.

III B.Tech I Sem

23A51501	CHEMISTRY OF ENERGY SYSTEMS	L	T	P	C
		3		-	3

COURSE OBJECTIVES	
1	To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2	To understand the basic concepts of processing and limitations of Fuel cells & their applications.
3	To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
4	Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5	To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.

COURSE OUTCOMES	
CO1	➢ Solve the problems based on electrode potential, Describe the Galvanic Cell ➢ Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
CO2	➢ Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell ➢ Discuss about the Basic design of fuel cells, Classify the fuel cell
CO3	➢ Differentiate between Photo and Photo electrochemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, ➢ Interpret advantages of photoelectron catalytic conversion.
CO4	➢ Apply the photo voltaic technology, Demonstrate about solar energy and prospects ➢ Illustrate the Solar cells, Discuss about concentrated solar power
CO5	➢ Differentiate Chemical and Physical methods of hydrogen storage, Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures ➢ Describe the liquification methods.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1												
CO2												
CO3												
CO4												
CO5												

UNIT-1: Electrochemical Systems: Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction ,Lead-acid ,Nickel- cadmium, Lithium ion batteries and their applications**.**

UNIT-2: Fuel Cells: Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

UNIT-3: Photo and Photo electrochemical Conversions: Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT-4: Solar Energy: Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications. .

UNIT-5: Hydrogen Storage: Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel , and Organic hydrogen carriers.

Text books

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

Reference Books:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by ArvindTiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4. Hydrogen storage by Levine Klebonoff

III B.Tech I Sem

23A52502a	**ENGLISH FOR COMPETITIVE EXAMINATIONS** **(Open Elective-I)** (Common to All Branches of Engineering)	L	T	P	C
		3	0	0	3

Course Objectives:

1. To enable the students to learn about the structure of competitive English
2. To understand the grammatical aspects and identify the errors
3. To enhance verbal ability and identify the errors
4. To improve word power to answer competitive challenges
5. To make them ready to crack competitive exams

Course Outcomes (CO): Blooms Level

By the end of the program students will be able to

- Identify the basics of English grammar and its importance L1, L2
- Explain the use of grammatical structures in sentences L1, L2
- Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams L3
- Analyze an unknown passage and reach conclusions about it. L4
- Choose the appropriate form of verbs in framing sentences L5
- Develop speed reading and comprehending ability thereby perform better in competitive exams L3

UNIT - I	**GRAMMAR-1**	Lecture Hrs

Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefinite-Degrees of Comparison-Adverbs-types- errors-Conjunctions-usage-

Prepositions-usage-Tag Questions, types-identifying errors- Practice

UNIT - II	**GRAMMAR-2**	Lecture Hrs

Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause-Voice-active voice and passive voice- reported Speech-Agreement- subject and verb-Modals-Spotting Errors-Practices

UNIT - III	**VERBAL ABILITY**	Lecture Hrs

Sentence completion-Verbal analogies-Word groups-Instructions-Critical reasoning-Verbal deduction-Select appropriate pair-Reading Comprehension-Paragraph-Jumbles-Selecting the proper statement by reading a given paragraph.

UNIT - IV	**READING COMPREHENSION AND VOCUBULARY**	Lecture Hrs
Competitive Vocabulary :Word Building – Memory techniques-Synonyms, Antonyms, Affixes-Prefix &Suffix-One word substitutes-Compound words-Phrasal Verbs-Idioms and Phrases-Homophones-Linking Words-Modifiers-Intensifiers - Mastering Competitive Vocabulary- Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods		
UNIT - V	**WRITING FOR COMPETITIVE EXAMINATIONS**	Lecture Hrs
Punctuation- Spelling rules- Word order-Sub Skills of Writing- Paragraph meaning-salient features-types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing- Expansion of proverbs- Essay writing-types		

Textbooks:

1. Wren & Martin, *English for Competitive Examinations,* S.Chand & Co, 2021

2. *Objective English for Competitive Examination***,** Tata McGraw Hill, New Delhi, 2014.

Reference Books:

1. Hari Mohan Prasad, *Objective English for Competitive Examination*, Tata McGraw Hill, New Delhi, 2014.
2. Philip Sunil Solomon, *English for Success in Competitive Exams*, Oxford 2016
3. Shalini Verma , *Word Power Made Handy*, S Chand Publications
4. Neira, Anjana Dev & Co. *Creative Writing: A Beginner's Manual.* Pearson Education India, 2008.
5. Abhishek Jain,Vocabulary Learning Techniques Vol.I&II,RR Global Publishers 2013.
6. Michel Swan, *Practical English Usage*,Oxford,2006.

Online Resources

1. https://www.grammar.cl/english/parts-of-speech.htm
2. https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech
3. https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice
4. https://languagetool.org/insights/post/verb-tenses/
5. https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council
6. https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx

23A52502b	ENTREPRENEURSHIP AND NEW VENTURE CREATION (Open Elective-I)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES: The objectives of this course are	
1	To foster an entrepreneurial mind-set for venture creation and intrapreneurial leadership.
2	To encourage creativity and innovation
3	To enable them to learn pitching and presentation skills
4	To make the students understand MVP development and validation techniques to determine Product-Market fit and Initiate Solution design, Prototype for Proof of Concept.
5	To enhance the ability of analyzing Customer and Market segmentation, estimate Market size, develop and validate Customer Persona

UNIT-I: Entrepreneurship Fundamentals and context

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16industries to choose from), Venture Activity

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand theconcept of Entrepreneur and Entrepreneurship in India
- Analyze recent trends in Entrepreneurship role in economic development
- Develop a creative mind set and personality in starting a business.

Unit II: Problem & Customer Identification

Understanding and analysing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion - identifying and defining problem using Design thinking principles - Analysing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

Core Teaching Tool: Several types of activities including Class, game, Gen AI, ‘Get out of the Building’ and Venture Activity.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the problem and Customer identification.
- Analyze problem and validating with potential customer
- Evaluate customer segmentation and customer personas

Unit III: Solution design, Prototyping & Opportunity Assessment and Sizing

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer's needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Analyze jobs-to-be-done
- Evaluate customer needs to create a strong value proposition
- Design and draw prototyping and MVP

UNIT-IV: Business & Financial Model, Go-to-Market Plan

Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach.

Business planning: components of Business plan- Sales plan, People plan and financial plan.

Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analysing financial performance.

Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy.

Choosing a form of business organization specific to your venture, identifying sources of funds: Debt& Equity, Map the Start-up Life-cycle to Funding Options.

Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to:

- Understand lean approach in business models
- Apply business plan, sales plan and financial plan

- Analyze financial planning, marketing channels of distribution.
- Design their own venture and source of funds.

UNIT-V: Scale Outlook and Venture Pitch readiness

Understand and identify potential and aspiration for scale vis-a-vis your venture idea.

Persuasive Storytelling and its key components. Build an Investor ready pitch deck.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand aspiration for scale
- Analyze venture idea and its key components
- Evaluate and build investors ready pitch

TEXT BOOKS

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha . *Entrepreneurship*, McGrawHill, 11th Edition.(2020)
2. Ries, E. *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*. Crown Business,(2011).
3. Osterwalder, A., & Pigneur, Y. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers.* John Wiley & Sons. (2010).

REFERENCES

1. Simon Sinek,*Start with Why,* Penguin Books limited. (2011)
2. Brown Tim,*Change by Design Revised & Updated: How Design Thinking*
3. *Transforms Organizations and Inspires Innovation,* Harper Business.(2019)
4. Namita Thapar (2022) The Dolphin and the Shark: Stories on Entrepreneurship, Penguin Books Limited
5. Saras D. Sarasvathy, (2008) Effectuation: Elements of Entrepreneurial Expertise, Elgar Publishing Ltd.

E-RESOURCES

Learning resource- Ignite 5.0 Course Wadhwani platform (Includes 200+ components of custom created modular content + 500+ components of the most relevant curated content)

COURSE OUTCOMES: At the end of the course, students will be able to		**BTL**
CO1	Develop an entrepreneurial mindset and appreciate the concept of entrepreneurship	L3
CO2	Comprehend the process of problem-opportunity identification through	L3

	design thinking, identify market potential and customers while developing a compelling value proposition solution	
CO3	Analyze and refine business models to ensure sustainability and profitability	L3
CO4	Build Prototype for Proof of Concept and validate MVP of their practice venture idea	L4
CO5	Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture	L5
CO6	Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders	L6

BTL: Bloom's Taxonomy Level

III B.Tech. II Semester

Course Code	**DISASTER MANAGEMENT**	L	T	P	C
23A01606a	**(Open Elective – II)**	3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. To analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. To apply wind engineering principles and computational techniques in designing wind-resistant structures.
4. To evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. To assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

Course Outcomes:

After successful completion of this course, students will be able to:

1. Understand the fundamental concepts of natural disasters, their occurrence, and disaster risk reduction strategies.
2. Analyze the impact of cyclones on structures and explore retrofitting techniques for adaptive reconstruction.
3. Apply wind engineering principles and computational techniques in designing wind-resistant structures.
4. Evaluate earthquake effects on buildings and develop strategies for seismic retrofitting.
5. Assess seismic safety planning, design considerations, and innovative construction materials for disaster-resistant structures.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	-	2	-	2	2	-	-	-	3	3
CO -2	-	3	-	-	2	-	-	-	-	-	-	2	3	-
CO -3	3	-	-	3	-	-	3	-	-	2	-	-	-	3
CO -4	-	-	3	-	3	-	-	2	-	-	-	-	3	-
CO -5	-	-	-	3	-	3	3	3	2	-	-	-	-	3

UNIT – I

Introduction to Natural Disasters– Brief Introduction to Different Types of Natural Disasters, Occurrence of Disasters in Different Climatic and Geographical Regions, Hazard Maps (Earthquake and Cyclone) of The World and India, Regulations for Disaster Risk Reduction, Post-Disaster Recovery and Rehabilitation (Socioeconomic Consequences).

UNIT – II		
Cyclones and Their Impact– Climate Change and Its Impact On Tropical Cyclones, Nature of Cyclonic Wind, Velocities and Pressure, Cyclone Effects, Storm Surges, Floods, and Landslides. Behavior of Structuresin Past Cyclones and Windstorms, Case Studies. Cyclonic Retrofitting, Strengthening of Structures, and Adaptive Sustainable Reconstruction. Life-Line Structures Such as Temporary Cyclone Shelters.		
UNIT – III		
Wind Engineering and Structural Response– Basic Wind Engineering, Aerodynamics of Bluff Bodies, Vortex Shedding, and Associated Unsteadiness Along and Across Wind forces. Lab: Wind Tunnel Testing and Its Salient Features. Introduction to Computational Fluid Dynamics (CFD). General Planning and Design Considerations Under Windstorms and Cyclones. Wind Effects On Buildings, towers, Glass Panels, Etc., and Wind-Resistant Features in Design. Codal Provisions, Design Wind Speed, Pressure Coefficients. Coastal Zoning Regulations for Construction and Reconstruction in Coastal Areas. Innovative Construction Materials and Techniques, Traditional Construction Techniques in Coastal Areas.		
UNIT – IV		
Seismology and Earthquake Effects– Causes of Earthquakes, Plate Tectonics, Faults, Seismic Waves; Magnitude, Intensity, Epicenter, Energy Release, and Ground Motions. Earthquake Effects– On Ground, Soil Rupture, Liquefaction, Landslides. Performance of Ground and Buildings in Past Earthquakes– Behavior of Various Types of Buildings and Structures, Collapse Patterns; Behavior of Non-Structural Elements Such as Services, Fixtures, and Mountings – Case Studies. Seismic Retrofitting– Weakness in Existing Buildings, Aging, Concepts in Repair, Restoration, and Seismic Strengthening.		
UNIT – V		
Planning and Design Considerations for Seismic Safety– General Planning and Design Considerations; Building forms, Horizontal and Vertical Eccentricities, Mass and Stiffness Distribution, Soft Storey Effects, Etc.; Seismic Effects Related to Building Configuration. Plan and Vertical Irregularities, Redundancy, and Setbacks. Construction Details– Various Types of Foundations, Soil Stabilization, Retaining Walls, Plinth Fill, Flooring, Walls, Openings, Roofs, Terraces, Parapets, Boundary Walls, Underground and Overhead Tanks, Staircases, and Isolation of Structures. Innovative Construction Materials and Techniques. Local Practices– Traditional Regional Responses. Computational Investigation Techniques.		
TEXT BOOKS:		
1. David Alexander, *Natural Disasters*, 1st Edition, CRC Press, 2017. 2. Edward A. Keller and Duane E. DeVecchio, *Natural Hazards: Earth's Processes as Hazards, Disasters, and Catastrophes*, 5th Edition, Routledge, 2019.		
REFRENCE BOOKS:		
1. Ben Wisner, J.C. Gaillard, andIlanKelman (Editors), *Handbook of Hazards and Disaster Risk Reduction and Management*, 2nd Edition, Routledge, 2012. 2. Damon P. Coppola, *Introduction to International Disaster Management*, 4th Edition, Butterworth-Heinemann, 2020.		

3. BimalKanti Paul, *Environmental Hazards and Disasters: Contexts, Perspectives and Management*, 2nd Edition, Wiley-Blackwell, 2020.

Online Learning Resources:

https://nptel.ac.in/courses/124107010

https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

III B.Tech – II Semester

Course Code	**SUSTAINABILITY IN ENGINEERING PRACTICES (OE – II)**	L	T	P	C
23A01606b		3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. To analyze sustainable construction materials, their durability, and life cycle assessment.
3. To apply energy calculations in construction materials and assess their embodied energy.
4. To evaluate green building standards, energy codes, and performance ratings.
5. To assess the environmental effects of energy use, climate change, and global warming.

Course Outcomes:

After successful completion of this course, students will be able to:

1. Understand the fundamentals of sustainability, the carbon cycle, and the environmental impact of construction materials.
2. Analyze sustainable construction materials, their durability, and life cycle assessment.
3. Apply energy calculations in construction materials and assess their embodied energy.
4. Evaluate green building standards, energy codes, and performance ratings.
5. Assess the environmental effects of energy use, climate change, and global warming.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	-	2	3	2	-	-	-	-	3	3
CO -2	-	3	-	-	2	-	3	-	-	-	-	2	3	3
CO -3	-	-	3	3	3	-	2	-	-	2	-	-	3	3
CO -4	-	-	3	3	3	-	3	2	-	-	-	-	3	3
CO -5	-	-	-	-	-	3	3	3	-	-	-	-	-	3

UNIT – I

INTRODUCTION

Introduction and Definition of Sustainability - Carbon Cycle - Role of Construction Material: Concrete and Steel, Etc. - CO_2Contribution From Cement and Other Construction Materials.

UNIT – II

MATERIALS USED in SUSTAINABLE CONSTRUCTION

Construction Materials and Indoor Air Quality - No/Low Cement Concrete - Recycled and Manufactured Aggregate - Role of QC and Durability - Life Cycle and Sustainability.

UNIT – III		

ENERGY CALCULATIONS

Components of Embodied Energy - Calculation of Embodied Energy for Construction Materials - Energy Concept and Primary Energy - Embodied Energy Via-A-Vis Operational Energy in Conditioned Building - Life Cycle Energy Use

UNIT – IV		

GREEN BUILDINGS

Control of Energy Use in Building - ECBC Code, Codes in Neighboring Tropical Countries - OTTV Concepts and Calculations – Features of LEED and TERI – GRIHA Ratings - Role of Insulation and Thermal Properties of Construction Materials - Influence of Moisture Content and Modeling - Performance Ratings of Green Buildings - Zero Energy Building

UNIT – V		

ENVIRONMENTAL EFFECTS

Non-Renewable Sources of Energy and Environmental Impact– Energy Norm, Coal, Oil, Natural Gas - Nuclear Energy - Global Temperature, Green House Effects, Global Warming - Acid Rain: Causes, Effects and Control Methods - Regional Impacts of Temperature Change.

TEXT BOOKS:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.

REFRENCE BOOKS:

1. Craig A. Langston & Grace K.C. Ding, Sustainable Practicesin the Built Environment, Butterworth Heinemann Publishers, 2011.
2. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/105/105105157/

III B.Tech. II Semester

23A02605	RENEWABLE ENERGY SOURCES (Open Elective-II)	L	T	P	C
		3	0	0	3

Course Outcomes (CO): At the end of the course the student will be able to:

CO 1: Understand principle operation of various renewable energy sources. L1

CO 2: Identify site selection of various renewable energy sources. L2

CO 3: Analyze various factors affecting on solar energy measurements, wind energy conversion techniques, Geothermal, Biomasss, Tidal Wave and Fuel cell energies L3

CO 4: Design of Solar PV modules and considerations of horizontal and vertical axis Wind energy systems. L5

CO 5: Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power. L4

UNIT I Solar Energy:

Solar radiation - beam and diffuse radiation, solar constant, Sun at Zenith, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT II PV Energy Systems:

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Solar PV modules from solar cells, mismatch in series and parallel connections design and structure of PV modules, Electrical characteristics of silicon PV cells and modules, Stand-alone PV system configuration, Grid connected PV systems.

UNIT III Wind Energy:

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades; wind data and energy estimation and site selection considerations.

UNIT IV Geothermal Energy:

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT – V Miscellaneous Energy Technologies:

Ocean Energy: Tidal Energy-Principle of working, Operation methods, advantages and limitations. Wave Energy-Principle of working, energy and power from waves, wave energy conversion devices, advantages and limitations.

Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration

Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Text books:

1.G. D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, 2000.

2.Chetan Singh Solanki "Solar Photovoltaics fundamentals, technologies and applications" 2nd Edition PHI Learning Private Limited. 2012.

Reference Books:

1.Stephen Peake, "Renewable Energy Power for a Sustainable Future", Oxford International Edition, 2018.

2.S. P. Sukhatme, "Solar Energy",3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.

3.B H Khan , " Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.

4.S. Hasan Saeed and D.K.Sharma,"Non-Conventional Energy Resources",3rd Edition, S.K.Kataria& Sons, 2012.

5.G. N. Tiwari and M.K.Ghosal, "Renewable Energy Resource: Basic Principles and Applications", Narosa Publishing House, 2004.

Online Learning Resources:

1. https://nptel.ac.in/courses/103103206

2. https://nptel.ac.in/courses/108108078

III B. Tech -II Sem

23A03606	**AUTOMATION AND ROBOTICS** (Open Elective – II)	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Fundamentals of industrial automation, production types, automation strategies, and hardware elements used in modern manufacturing processes.
2	Understanding of automated manufacturing systems, and strategies for improving productivity and flexibility in industrial automation.
3	Knowledge of industrial automation and robotics, sensors, and end-effector design for modern manufacturing environments.
4	Explain industrial automation and robotics, and trajectory planning for intelligent and efficient manufacturing applications.
5	Familiarity of industrial automation and robotics, and practical applications in manufacturing processes.

COURSE OUTCOMES On successful completion of this course the student will be able to		
1	Understand and analyze the structure and functions of automated manufacturing systems, and evaluate hardware components for efficient production.	*L2,L4,L5*
2	Analyze and design automated flow lines with or without buffer storage, perform quantitative evaluations, apply assembly line balancing techniques.	L4,L5,L6
3	Classify robot configurations, select suitable actuators and sensors, analyze and apply automation and robotics principles to optimize production efficiency and flexibility.	L2,L3,L4
4	Apply kinematic and dynamic modeling using D-H notation and select appropriate hardware and control strategies for real-world industrial scenario to analyze and design automated and robotic systems.	L3,L4,L5
5	Design, program, and implement robotic systems, understand and apply robotics technology to manufacturing tasks.	L1,L3,L6

UNIT-I

Introduction to Automation:

Introduction to Automation, Need, Types, Basic elements of an automated system, Manufacturing Industries, Types of production, Functions in manufacturing, Organization and information processing in manufacturing, Automation strategies and levels of automation, Hardware components for automation and process control, mechanical feeders, hoppers, orienters, high speed automatic insertion devices.

UNIT –II

Automated flow lines:

Automated flow lines, Part transfer methods and mechanisms, types of Flow lines, flow line with/without buffer storage, Quantitative analysis of flow lines. Assembly line balancing: Assembly process and systems assembly line, line balancing methods, ways of improving line balance, flexible assembly lines.

UNIT- III

Introduction to Industrial Robotics:

Introduction to Industrial Robotics, Classification of Robot Configurations, functional line diagram, degrees of freedom. Components common types of arms, joints grippers, factors to be considered in the design of grippers.

Robot actuators and Feedback components: Actuators, Pneumatic, Hydraulic actuators, Electric & Stepper motors, comparison. Position sensors - potentiometers, resolvers, encoders - velocity sensors, Tactile sensors, Proximity sensors.

UNIT- IV

Manipulator Kinematics:

Manipulator Kinematics, Homogenous transformations as applicable to rotation and transition - D-H notation, Forward inverse kinematics.

Manipulator Dynamics: Differential transformations, Jacobians, Lagrange - Euler and Newton – Euler formations. Trajectory Planning: Trajectory Planning and avoidance of obstacles path planning, skew motion, joint integrated motion - straight line motion.

UNIT- V

Robot Programming:

Robot Programming, Methods of programming - requirements and features of programming languages, software packages. Problems with programming languages.

Robot Application in Manufacturing: Material Transfer - Material handling, loading and unloading - Process - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books:

1. Automation , Production systems and CIM,M.P. Groover /Pearson Edu.
2. Industrial Robotics - M.P. Groover, TMH.
3.

References:

1. Robotics , Fu K S, McGraw Hill, 4th edition, 2010.
2. An Introduction to Robot Technology, P. Coiffet and M. Chaironze, Kogam Page Ltd. 1983 London.
3. Robotic Engineering , Richard D. Klafter, Prentice Hall

4. Robotics, Fundamental Concepts and analysis – Ashitave Ghosal ,Oxford Press, 1/e, 2006
5. Robotics and Control , Mittal R K &Nagrath I J , TMH.

Online Learning Resources:

https://www.youtube.com/watch?v=yxZm9WQJUA0&list=PLRLB5WCqU54UJG45UnazSYmnmhl-gt76o

https://www.youtube.com/watch?v=6f3bvIhSWyM&list=PLRLB5WCqU54X5Vy4DwjfSODT3ZJgwEjyE

III B.Tech II Sem

23A32502T	**OPERATING SYSTEMS**	**L**	**T**	**P**	**C**
	(Open Elective-II)	**3**	**0**	**0**	**3**

Course Objectives: The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

Course Outcomes: After completion of the course, students will be able to

CO1: Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication. (L1)

CO2: Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection. (L2)

CO3: Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system. (L3)

CO4: Illustrate different conditions for deadlock and their possible solutions. (L2) Analyze the memory management and its allocation policies. (L4)

CO5: Able to design and implement file systems, focusing on file access methods, directory structure, free space management, and also explore various protection mechanisms,

UNIT - I Operating Systems Overview, System Structures Lecture 8Hrs

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, systems calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Operating system debugging, System Boot.

UNIT - II Process Concept, Multithreaded Programming, Process Scheduling, Inter-process Communication Lecture 10Hrs

Process Concept: Process scheduling, Operations on processes, Inter-process communication, Communication in client server systems. Multithreaded Programming: Multithreading models, Thread libraries, Threading issues, Examples. Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling, Thread scheduling, Examples. Inter-process Communication: Race conditions, Critical Regions, Mutual exclusion with busy waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message passing, Barriers, Classical IPC Problems - Dining philosophers problem, Readers and writers problem.

UNIT - III Memory-Management Strategies, Virtual Memory Management Lecture 8Hrs

Memory-Management Strategies: Introduction, Swapping, Contiguous memory allocation, Paging, Segmentation, Examples. Virtual Memory Management: Introduction, Demand paging, Copy on-write, Page replacement, Frame allocation, Thrashing, Memory-mapped files, Kernel memory allocation, Examples.

UNIT - IV Deadlocks, File Systems Lecture 9Hrs

Deadlocks: Resources, Conditions for resource deadlocks, Ostrich algorithm, Deadlock detection And recovery, Deadlock avoidance, Deadlock prevention. File Systems: Files, Directories, File system implementation, management and optimization. Secondary-Storage Structure: Overview of disk structure, and attachment, Disk scheduling, RAID structure, Stable storage implementation.

UNIT - V System Protection, System Security Lecture 8Hrs

System Protection: Goals of protection, Principles and domain of protection, Access matrix, Access control, Revocation of access rights. System Security: Introduction, Program threats, System and network threats, Cryptography as a security, User authentication, implementing security defenses, firewalling to protect systems and networks, Computer security classification. Case Studies: Linux, Microsoft Windows.

Textbooks:

1. Silberschatz A, Galvin P B, and Gagne G, Operating System Concepts, 9th edition, Wiley, 2016.

2. Tanenbaum A S, Modern Operating Systems, 3rd edition, Pearson Education, 2008. (Topics: Inter-process Communication and File systems.)

Reference Books:

1. Tanenbaum A S, Woodhull A S, Operating Systems Design and Implementation, 3rd edition, PHI, 2006.

2. Dhamdhere D M, Operating Systems A Concept Based Approach, 3rd edition, Tata McGraw Hill, 2012.

3. Stallings W, Operating Systems -Internals and Design Principles, 6th edition, Pearson Education, 2009

4. Nutt G, Operating Systems, 3rd edition, Pearson Education, 2004

Online Learning Resources:

https://nptel.ac.in/courses/106/106/106106144/

http://peterindia.net/OperatingSystems.html

III B.Tech – II Sem

23A32501T	INTRODUCTION TO MACHINE LEARNING (Open Elective-II)	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamental concepts and types of machine learning.
- To develop a deep understanding of supervised and unsupervised learning algorithms.
- To understand mathematical foundations of learning models and algorithms.
- To evaluate model performance using appropriate statistical and analytical tools.
- To apply machine learning techniques to solve real-world problems using tools such as Scikit-learn.

Course Outcomes:

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

- Understand and distinguish among different types of learning methods.
- Apply supervised and unsupervised learning algorithms to datasets.
- Analyze model performance using cross-validation and error metrics.
- Build, test, and improve machine learning models for classification and prediction.
- Use Python-based libraries (e.g., Scikit-learn) to implement ML algorithms.

UNIT I: Introduction to Machine Learning and Linear Models

Definition and Scope of Machine Learning, Applications and Types of Learning: Supervised, Unsupervised, Reinforcement, Linear Regression: Least Squares, Cost Function, Gradient Descent, Polynomial Regression and Overfitting, Evaluation Metrics: RMSE, MAE, R^2 Score, Bias-Variance Trade off.

UNIT II: Classification Algorithms

Classification Overview and Decision Boundaries, Logistic Regression: Sigmoid Function and Cost, K-Nearest Neighbors (KNN), Naïve Bayes Classifier, Decision Trees and Random Forests, Model Evaluation: Confusion Matrix, Precision, Recall, F1-Score.

UNIT III: Support Vector Machines and Ensemble Methods

Support Vector Machines: Concepts, Kernels, Hyperplane and Margin Concepts, Kernel Tricks: RBF and Polynomial, Ensemble Learning: Bagging, Boosting, and Voting, Gradient Boosting, AdaBoost, and XGBoost, Model Tuning and Hyperparameter Optimization.

UNIT IV: Unsupervised Learning Techniques

Clustering Overview: Applications, K-Means Clustering Algorithm, Hierarchical Clustering, DBSCAN and Density-Based Methods, Principal Component Analysis (PCA) for Dimensionality Reduction, Silhouette Score, Davies-Bouldin Index for Cluster Validation.

UNIT V: Advanced Topics and Applications

Reinforcement Learning Basics and Markov Decision Processes, Introduction to Neural Networks and Deep Learning, Cross-Validation Techniques: k-Fold, Leave-One-Out, Feature Engineering and Feature Selection, Deployment of ML Models (Flask, Streamlit, etc.), Case Studies: Medical Diagnosis, Spam Detection, Credit Scoring.

Textbooks:

1. Tom Mitchell, **Machine Learning**, McGraw-Hill Education.
2. Aurélien Géron, **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow**, O'Reilly Media.
3. Ethem Alpaydin, **Introduction to Machine Learning**, MIT Press.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, **The Elements of Statistical Learning**, Springer.
2. Kevin P. Murphy, **Machine Learning: A Probabilistic Perspective**, MIT Press.
3. Christopher Bishop, **Pattern Recognition and Machine Learning**, Springer.

Online Learning Resources:

1. Coursera – Machine Learning by Andrew Ng (Stanford University)
2. Scikit-learn Documentation
3. Kaggle Learn – Machine Learning
4. Google's Machine Learning Crash Course

YouTube – StatQuest with Josh Starmer

III B.Tech II Sem

23A54601a	**OPTIMIZATION TECHNIQUES**	**L**	**T**	**P**	**C**
	(Open Elective -II)	**3**	**0**	**0**	**3**

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.	L2, L3
CO2	Interpret the transportation models' solutions and infer solutions to the real-world problems.	L3, L5
CO3	Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications.	L3
CO4	Apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives	L2, L3
CO5	Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives.	L3,L5

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	-	-	-	-	-	-	-	1
CO2	3	2	2	2	-	-	-	-	-	-	-	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1

1-Slightly, 2-Moderately, 3-Substantially.

UNIT – I: Linear programming I (08)

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method, Big-M method.

UNIT – II Linear programming II: Duality in Linear Programming (08)

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

UNIT – III Non-linear programming: Unconstrained optimization techniques (08)

Introduction: Classification of Unconstrained minimization methods,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

UNIT – IV Non-linear programming: Constrained optimization techniques (08)

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

UNIT-V Geometric Programming **(08)**

Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

TEXT BOOK:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

REFERENCES:

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

Web Reference:

- https://onlinecourses.nptel.ac.in/noc24_ee122/preview
- https://archive.nptel.ac.in/courses/111/105/111105039/
- https://onlinecourses.nptel.ac.in/noc21_ce60/preview

23A54601b	MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES Open Elective – II	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide a strong mathematical foundation for understanding Quantum Mechanics.
- To equip students with fundamental basis of the statistical theory, Conclusions from Experiments, Measurement, and reversibility.
- To enhance the ability to apply the concept in Thermodynamics, Reversibility and equilibrium problems and Macroscopic Measurement.
- To develop critical problem-solving skills for composite system and measuring process.

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Understand the Transformation theory and Hilbert space.	L1 (Understand)
CO2	Analyze the properties and operators of Hilbert space and apply Eigen values to it.	L3, L4 (Apply and Analyze)
CO3	Apply statistics to measure theory, uncertainty relations and radiation theory.	L3 (Apply)
CO4	Evaluate problems on reversibility, equilibrium and macroscopic measurements.	L5 (Evaluate)
CO5	Formulate problems of composite system and measuring process	L6 (Formulation)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	2	3	2	-	-	-	-	-	-	2
CO3	3	3	3	3	2	1	-	-	-	-	-	2

CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	3	3	2	-	-	-	-	-	-	2

• **3** = Strong Mapping, **2** = Moderate Mapping, **1** = Slight Mapping, **-** = No Mapping

UNIT I: Introductory Considerations(08)

The origin of the Transformation Theory, The Original Formulation of Quantum Mechanics, The Equivalence of the two Theories: (i) The Transformation Theory, (ii) Hilbert Space.

UNIT II: Abstract Hilbert Space(10)

The definition of Hilbert space, The Geometry of Hilbert space, Degression on the Conditions A-E, Closed linear Manifolds, Operators in Hilbert space, The Eigen Value Problem, Continuation, Initial Consideration concerning the Eigenvalue Problem, Degression on the Existence and Uniqueness of solutions of the Eigenvalue Problems, Cumulative operators, The Trace.

UNIT III: The Quantum Statistics(08)

The statistical assertions of quantum mechanics, the statistical interpretation, Simultaneous Measurability and Measurability in General, Uncertainty Relations, Projections as Propositions, Radiation Theory.

UNIT IV: Deductive development of the Theory and general considerations(08)

The fundamental basis of the statistical theory, Conclusions from Experiments.

Measurement and reversibility, Thermodynamics Considerations, Reversibility and equilibrium problems, The Macroscopic Measurement.

UNIT V: The measuring Process(06)

Formulation of the problems, Composite systems, discussion of the Measuring process.

Textbooks:

3. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press (1996).
4. Srinivas, M. D., Measurements and Quantum Probabilities, University Press, Hyderabad (2001).

Reference Books:

3. Leonard Schiff, Quantum Mechanics, Mc, Graw Hill (Education) (2010).
4. Parthasarathy. K. R., Mathematical Foundations of Quantum, Hindustan Book Agency, New Delhi.

Gerad Tesch, Mathematical Methods in Quantum Mechanics with application to Schrodinger operators, Graduate Studies in Mathematics, 99, AMS, Providence, 2009

III B.Tech II Sem

23A56601	**PHYSICS OF ELECTRONIC MATERIALS AND DEVICES** **(Common to all branches)** **Open Elective-II**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives	
1	To make the students to understand the concept of crystal growth, defects in crystals and thin films.
2	To provide insight into various semiconducting materials and their properties.
3	To develop a strong foundation in semiconductor physics and device engineering.
4	To elucidate excitonic and luminescent processes in solid-state materials.
5	To understand the principles, technologies, and applications of modern display systems.

Syllabus:

UNIT-I Fundamentals of Materials Science **9H**

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT II Semiconductors **9H**

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT III Physics of Semiconductor Devices:
9H

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

UNIT IV Excitons and Luminescence: **9H**

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter-band luminescence, Direct and indirect gap materials.

Photoluminescence : General Principles of photoluminescence, Excitation and relaxation, OLED, Quantum-dot.

Electro-luminescence : General Principles of electroluminescence, light emitting diode, diode laser.

UNIT V Display devices : 9H

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Textbooks:

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,4th edition, 2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. Electronic Components and Materials, Grover and Jamwal, DhanpatRai and Co., New Delhi., 2012.
4. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd. 2nd Edition,2011

NPTEL course links:

https://nptel.ac.in/courses/113/106/113106062/

https://onlinecourses.nptel.ac.in/noc20_ph24/preview

	Course Outcomes	Blooms Level
CO1	Understand crystal growth and thin film preparation	L1,L2
CO2	Summarize the basic concepts of semiconductors	L1,L2
CO3	Illustrate the working of various semiconductor devices	L1,L2, L3
CO4	Analyze various luminescent phenomena and the devices based on these concepts	L1,L2, L3
CO5	Explain the working of different display devices	L1,L2

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1							
CO2	3	3	2	1	1							
CO3	3	3	2	1	1							
CO4	3	2	1	1	-							
CO5	3	3	1	1	-							

1-Slightly, 2-Moderately,3-Substantially.

III B.Tech –II Sem

		L	T	P	C
23A51601	**CHEMISTRY OF POLYMERS AND APPLICATIONS** **(Common to all branches)** **Open Elective-II**	**3**	**0**	**0**	**3**

Course Objectives	
1	To understand the basic principles of polymers
2	To understand natural polymers and their applications.
3	To impart knowledge to the students about synthetic polymers, their preparation and importance.
4	To enumerate the applications of hydogel polymers
5	To enumerate applications of conducting and degradable polymers in engineering.

Course Outcomes	
CO1	Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
CO2	Describe the physical and chemical properties of natural polymers and Modified cellulosics.
CO3	Differentiate Bulk, solution, Suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers.
CO4	Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery,
CO5	Explain classification and mechanism of conducting and degradable polymers.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Unit – I: Polymers-Basics and Characterization:-

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation,

copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit – II: Natural Polymers & Modified cellulosics

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Unit – III: Synthetic Polymers

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers(PE,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

Unit-IV: Hydrogels of Polymer networks

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels**,** Applications of hydrogels in drug delivery.

Unit – V: Conducting and Degradable Polymers:

Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping,Applications.

Degradable polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

Text Books:

1. A Text book of Polymer science, Billmayer

2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

References Books:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall

2.Advanced Organic Chemistry, B.Miller, Prentice Hall

3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

III B.Tech –II Sem

23A52602	**ACADEMIC WRITING AND PUBLIC SPEAKING** **(Common to All Branches of Engineering)** **OPEN ELECTIVE - II**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To encourage all round development of the students by focusing on writing skills
- To make the students aware of non-verbal skills
- To develop analytical skills
- To deliver effective public speeches

Course Outcomes (CO): Blooms Level

By the end of the program students will be able to

- Understand various elements of Academic Writing L1, L2
- Identify sources and avoid plagiarism L1, L2
- Demonstrate the knowledge in writing a Research paper L3
- Analyse different types of essays L4
- Assess the speeches of others and know the positive strengths of speakers L5
- Build confidence in giving an impactful presentation to the audience L3

UNIT - I	Introduction to Academic Writing	Lecture Hrs

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing

UNIT - II	Academic Journal Article	Lecture Hrs

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism

UNIT - III	Essay & Writing Reviews	Lecture Hrs

Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- SoP

UNIT - IV	Public Speaking	Lecture Hrs

Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events

UNIT - V	Public Speaking and Non-Verbal Delivery	Lecture Hrs

Body Language – Facial Expressions-Kinesics – Oculesics – Proxemics – Haptics – Chronomics -Paralanguage - Signs
Textbooks:
1. *Critical Thinking, Academic Writing and Presentation Skills*: MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010) 2. Pease, Allan & Barbara. The Definitive Book of Body LanguageRHUS Publishers, 2016

Reference Books:

1. Alice Savage, Masoud Shafiei Effective Academic Writing,**2Ed.,**2014 Oxford University Press.
2. Shalini Verma, *Body Language*, S Chand Publications 2011.
3. Sanjay Kumar and Pushpalata,*Communication Skills* 2E 2015, Oxford.
4. Sharon Gerson, Steven Gerson,*Technical Communication Process and Product*, Pearson, New Delhi, 2014
5. *Elbow, Peter. Writing with Power. OUP USA, 1998*

Online Learning Resources:

1. https://youtu.be/NNhTIT81nH8
2. phttps://www.youtube.com/watch?v=478ccrWKY-A
3. https://www.youtube.com/watch?v=nzGo5ZC1gMw
4. https://www.youtube.com/watch?v=Qve0ZBmJMh4
5. https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal-aspects-of-delivery/
6. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
7. https://archive.nptel.ac.in/courses/109/107/109107172/#
8. https://archive.nptel.ac.in/courses/109/104/109104107/

IV B.Tech – I Semester

Course Code	**BUILDING MATERIALS AND SERVICES (OPEN ELECTIVE – III)**	L	T	P	C
23A01704a		3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
2. To analyze the composition, manufacturing process, and properties of cement and admixtures.
3. To apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
4. To evaluate masonry, mortars, finishing techniques, and formwork systems.
5. To assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Understand the properties, classifications, and applications of building materials like stones, bricks, tiles, wood, aluminum, glass, paints, and plastics.
2. Analyze the composition, manufacturing process, and properties of cement and admixtures.
3. Apply knowledge of building components such as lintels, arches, walls, stairs, floors, roofs, foundations, and joinery.
4. Evaluate masonry, mortars, finishing techniques, and formwork systems.
5. Assess various building services including plumbing, ventilation, air conditioning, acoustics, and fire protection.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	2	-	-	-	-	-	-	-	3	3
CO -2	3	3	-	-	2	-	-	-	-	-	-	2	3	3
CO -3	3	-	3	2	3	-	-	-	-	-	-	-	3	3
CO -4	-	-	3	3	3	-	2	-	-	-	-	-	3	3
CO -5	-	-	-	-	-	3	3	2	-	-	-	-	-	3

UNIT – I

StonesandBricks, Tiles: Building Stones – Classifications and Quarrying – Properties – Structural Requirements – Dressing. Bricks – CompositionofBrick Earth – Manufacture and Structural Requirements, Fly Ash, Ceramics. Timber, Aluminum, Glass, PaintsandPlastics: Wood - Structure – Types and Properties – Seasoning – Defects; Alternate Materials for Timber

– GI / Fibre – Reinforced Glass Bricks, Steel & Aluminum, Plastics.

UNIT – II

Cement &Admixtures: Types of Cement - Ingredients of Cement – Manufacture – Chemical Composition – Hydration - Field & Lab Tests – Fineness – Consistency – Initial &Final Setting – Soundness . Admixtures – Mineral & Chemical Admixtures – Uses

UNIT – III

Building Components: Lintels, Arches, Walls, Vaults – Stair Cases – Types of Floors, Types of Roofs – Flat, Curved, Trussed; Foundations – Types; Damp Proof Course; Joinery – Doors – Windows – Materials – Types.

UNIT – IV

Mortars, MasonryandFinishing's Mortars: Lime and Cement Mortars Brick Masonry – Types – Bonds; Stone Masonry – Types; Composite Masonry – Brick-Stone Composite; Concrete, Reinforced Brick. Finishers: Plastering, Pointing, Painting, Claddings – Types – Tiles – ACP.form Work: Types: Requirements – Standards – Scaffolding – Design; Shoring, Underpinning.

UNIT – V

Building Services: Plumbing Services: Water Distribution, Sanitary – Lines &Fittings; Ventilations: Functional Requirements Systems of Ventilations. Air-Conditioning - Essentials andTypes; Acoustics – Characteristic – Absorption – Acoustic Design; Fire Protection – Fire Hazards – Classification of Fire Resistant Materials and Constructions.

TEXT BOOKS:

1. Building Materials and Construction – Arora&Bindra, Dhanpat Roy Publications.
2. Building Materials and Construction by G C Sahu, Joygopal Jena McGraw hill Pvt Ltd 2015.

REFRENCE BOOKS:

1. Building Construction by B. C. Punmia, Ashok Kumar Jain andArun Kumar Jain - Laxmi Publications (P) ltd., New Delh
2. P. C. Varghese, Building Materials, Prentice Hall of India, 2015.
3. N.Subramanian ,"Building Materials Testing and Sustainability", Oxford Higher Education, 2019.
4. R. Chudley, Construction Technology, Longman Publishing Group, 1973.
5. S. K. Duggal, Building Materials, Oxford & IBH Publishing Co. Ltd., New Delhi, 2019

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/102/105102088/

IV B.Tech – I Semester

Course Code	**ENVIRONMENTAL IMPACT ASSESSMENT** (**OPEN ELECTIVE – III**)	L	T	P	C
23A01704b		3	0	0	3

Course Objectives:

The objectives of this course are to make the student to:

1. Understand the principles, methodologies, and significance of Environmental Impact Assessment (EIA).
2. Analyze the impact of developmental activities on land use, soil, and water resources.
3. Evaluate the impact of development on vegetation, wildlife, and assess environmental risks.
4. Develop environmental audit procedures and assess compliance with environmental regulations.
5. Understand and apply environmental acts, notifications, and legal frameworks in EIA studies.

Course Outcomes (COs):

Upon successful completion of the course, students will be able to:

1. Apply various methodologies for conducting Environmental Impact Assessments.
2. Analyze the impact of land-use changes on soil, water, and air quality.
3. Evaluate the environmental impact on vegetation, wildlife, and conduct risk assessments.
4. Develop environmental audit reports and assess compliance with environmental policies.
5. Interpret and apply environmental acts and regulations related to EIA.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	2	2	2	2	3	-	-	-	-	-	1	2	2
CO -2	3	3	3	2	2	3	-	-	-	-	-	1	3	2
CO -3	3	3	3	2	2	3	3	-	-	-	-	1	3	3
CO -4	3	3	3	3	2	3	3	-	-	-	-	1	3	3
CO -5	2	2	2	2	2	3	3	3	-	-	-	1	2	2

UNIT – I

Concepts and methodologies of EIA

Initial Environmental Examination, Elements of EIA, - Factors Affecting E-I-A Impact Evaluation and Analysis, Preparation of Environmental Base Map, Classification of Environmental Parameters- Criteria for The Selection of EIA Methodology, E I A Methods, Ad-Hoc Methods, Matrix Methods, Network Method Environmental Media Quality Index Method, Overlay Methods and Cost/Benefit Analysis.

UNIT – II

Impact of Developmental Activities and Land Use

Introduction and Methodology for The Assessment of Soil and Ground Water, Delineation of Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. E I Ain Surface Water, Air and Biological Environment: Methodology for The Assessment of Impacts On Surface Water Environment, Air Pollution Sources, Generalized Approach for Assessment of Air Pollution Impact.

UNIT – III

Assessment of Impact On Vegetation, Wildlife and Risk Assessment

Introduction - Assessment of Impact of Development Activities On Vegetation and Wildlife, Environmental Impact of Deforestation – Causes and Effects of Deforestation - Risk Assessment and Treatment of Uncertainty-Key Stages in Performing An Environmental Risk Assessment- Advantages of Environmental Risk Assessment.

UNIT – IV

Environmental Audit

Introduction - Environmental Audit & Environmental Legislation Objectives of Environmental Audit, Types of Environmental Audit, Audit Protocol, Stages of Environmental Audit, Onsite Activities, Evaluation of Audit Data and Preparation of Audit Report

UNIT – V

Environmental Acts and Notifications

The Environmental Protection Act, The Water Preservation Act, The Air (Prevention &Control of Pollution Act), Wild Life Act - Provisions in The EIA Notification, Procedure for Environmental Clearance, Procedure for Conducting Environmental Impact Assessment Report-Evaluation of EIA Report. Environmental Legislation Objectives, Evaluation of Audit Data and Preparation of Audit Report. Post Audit Activities, ConceptofISO and ISO 14000.

TEXT BOOKS:

1. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011
2. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)

REFRENCE BOOKS:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G.Mc-Graw Hill International Editions, New York 1985.
2. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania& Sons Publication, New Delhi
3. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

Online Learning Resources:
https://archive.nptel.ac.in/courses/124/107/124107160/

IV B.Tech I Sem

23A02704	**SMART GRID TECHNOLOGIES**	**L**	**T**	**P**	**C**
	(Open Elective- III)	**3**	**0**	**0**	**3**

Course Outcomes:

CO1: Understanding the Concept and Evolution of Smart Grids. L2

CO2: Analyzing Wide Area Monitoring System and Synchrophasor Technology. L4

CO3: Applying Smart Metering and Advanced Metering Infrastructure (AMI) Concepts. L3

CO4: Evaluating Information and Communication Technology (ICT) Systems in Smart Grids. L5

CO5: Designing Smart Grid Applications and Cybersecurity Measures. L6

UNIT I Introduction to Smart Grid :

Evolution of Electric Grid – Need for Smart Grid – Difference between conventional & smart grid – Overview of enabling technologies – International experience in Smart Grid deployment efforts – Smart Grid road map for India – Smart Grid Architecture.

UNIT II Wide Area Monitoring System :

Fundamentals of Synchro phasor Technology – concept and benefits of Wide Area Monitoring System – Structure and functions of Phasor Measuring Unit (PMU) and Phasor Data Concentrator (PDC) – Road Map for Synchrophasor applications (NAPSI) – Operational experience and Blackout analysis using PMU - Case study on PMU.

UNIT III Smart Meters:

Features and functions of Smart Meters – Functional specification – category of Smart Meters – Automatic Meter Reading (AMR) and Advanced Metering Infrastructure (AMI) drivers and benefits – AMI protocol – Demand Side Integration: Peak load, Outage and Power Quality management.

UNIT IV Information and Communication Technology:

Overview of Smart Grid Communication system – Modulation and Demodulation Techniques: Radio Communication – Mobile Communication – Power Line Communication – Optical Fibre Communication – Communication Protocol for Smart Grid.

UNIT V

Smart Grid Applications and Cyber Security: Applications : Overview and concept of Renewable Integration – Introduction to distributed generation - Role of Protective Relaying in Smart Grid –

House Area Network – Advanced Energy Storage Technology: Flow battery – Fuel cell – SMES – Super capacitors – Plug – in Hybrid electric Vehicles - Cyber Security: Security issues in DG, Distribution Automation, AMI, Electric Vehicle Management Systems – Approach to assessment of smart grid cyber security risks – Methodologies. Cyber Security requirements – Smart Grid Information Model.

TEXT BOOKS:

1. James Momoh, "SMART GRID : Fundamentals of Design and Analysis", John Wiley and Sons, New York, 2012.
2. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley & Sons, New Jersey, 2012.

REFERENCES:

1. Power Grid Corporation of India Limited, "Smart Grid Primer", 1st Edition, Power Grid Corporation of India Limited, Bangalore, India, 2013.
2. Fereidoon.P.Sioshansi, "Smart Grid – Integrating Renewable, Distributed and Efficient Energy", 1st Edition, Academic Press, USA, 2011.
3. Stuart Borlase, "Smart Grids: Infrastructure, Technology and Solutions", 1st Edition, CRC Press Publication, England, 2013.
4. Phadke A G, Thorp J S, "Synchronized Phasor Measurements and Their Applications", 1st Edition, Springer, Newyork, 2012.

IV B.Tech I Sem

23A03704	**3D PRINTING TECHNOLOGIES**	**L**	**T**	**P**	**C**
	(Open Elective-III).	**3**	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	**Understand** the fundamental concepts of prototyping and distinguish between traditional and rapid prototyping methods.
2	**Demonstrate** the working principles, materials, and applications of solid-, liquid-, and powder-based RP systems.
3	**Define** the processes and classifications of rapid tooling and reverse engineering techniques.
4	**Identify** common errors in 3D printing and evaluate pre-processing, processing, and post-processing issues.
5	**Familiarize** RP-related software and its role in applications such as design, manufacturing, and medical fields.

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Define and explain the evolution and need for rapid prototyping in modern product development.	L1,L2,L6
2	Compare and contrast various 3D printing technologies based on working principles, materials, and limitations.	L2,L4
3	Apply knowledge of rapid tooling and reverse engineering techniques for industrial and design applications.	L3,L5,L6
4	Diagnose and interpret different types of errors encountered in 3D printing processes and recommend solutions.	L2,L3,L5 ,
5	Use RP-specific software tools to manipulate STL files and prepare models for printing in real-world scenarios.	L1,L3,L6

UNIT I Introduction to 3D Printing

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

UNIT II Solid and Liquid Based RP Systems

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

UNIT III Powder Based & Other RP Systems

Powder Based RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM).

Other RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Three Dimensional Printing (3DP), Ballastic Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

UNIT IV Rapid Tooling & Reverse Engineering

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development

UNIT V

Errors in 3D Printing and Applications:

Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc. Software: Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP. Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Textbooks:

1. Chee Kai Chua and Kah Fai Leong, "3D Printing and Additive Manufacturing Principles and Applications" 5/e, World Scientific Publications, 2017.

2. Ian Gibson, David W Rosen, Brent Stucker, "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", Springer, 2/e, 2010.

Reference Books:

1. Frank W.Liou, "Rapid Prototyping & Engineering Applications", CRC Press, Taylor & Francis Group, 2011.

2. Rafiq Noorani, "Rapid Prototyping: Principles and Applications in Manufacturing", John Wiley&Sons, 2006.

Online Learning Resources:

- NPTEL Course on Rapid Manufacturing.
- https://nptel.ac.in/courses/112/104/112104265/
- https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/
- https://slideplayer.com/slide/6927137/
- https://www.mdpi.com/2073-4360/12/6/1334
- https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-
- %20FDM.pdf
- https://lecturenotes.in/subject/197

- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdfcompressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- https://www.youtube.com/watch?v=NkC8TNts4B4.

IV B.Tech-I Sem

23A05402T	**DATA BASE MANAGEMENT SYSTEM (Open Elective-III)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the fundamental concepts of database systems and data modeling.
- To provide knowledge on relational databases and SQL for data retrieval and manipulation.
- To understand database design principles using normalization and ER modeling.
- To study transaction management, concurrency control, and database recovery.
- To explore emerging database technologies and architectures including NoSQL.

Course Outcomes (COs):

After successful completion of this course, students will be able to:

- **CO1**: Understand the basic concepts of database systems and their architecture.
- **CO2**: Apply ER modeling and relational algebra for database design.
- **CO3**: Analyze and implement normalization techniques for schema refinement.
- **CO4**: Evaluate transaction management techniques, concurrency control, and recovery.
- **CO5**: Explore non-relational databases and recent trends in database systems.

UNIT I: Introduction to Databases

Database System Applications and Purpose, View of Data: Data Abstraction and Data Independence, Database Users and Administrators, DBMS Architecture and Data Models, ER Model: Entities, Attributes, Relationships, ER Diagrams, Reduction of ER Model to Tables

UNIT II: Relational Model and Algebra

Structure of Relational Databases, Relational Model Concepts and Integrity Constraints, Relational Algebra: Selection, Projection, Set Operations, Joins, Tuple Relational Calculus, Introduction to SQL: DDL, DML, DCL, Advanced SQL: Sub queries, Joins, Views, Indexes

UNIT III: Database Design and Normalization

Schema Design and Logical Database Design, Functional Dependencies, Normal Forms: 1NF, 2NF, 3NF, BCNF, Decomposition and Lossless Join, Dependency Preservation, Multi-Valued and Join Dependencies.

UNIT IV: Transaction Management and Concurrency Control

Concept of a Transaction, ACID Properties, Serializability and Schedules, Concurrency Control: Lock-Based, Timestamp-Based Protocols, Deadlock Handling, Recovery Techniques: Log-Based, Shadow Paging

UNIT V: Advanced Topics and NoSQL Databases

Distributed Databases and Parallel Databases, Introduction to NoSQL: Types – Document, Columnar, Key-Value, Graph, CAP Theorem, MongoDB: Basics and CRUD Operations, Big Data and New SQL Overview, Case Studies on Real-World Databases

Textbooks:

1. **Abraham Silberschatz, Henry F. Korth, S. Sudarshan** – ***Database System Concepts***, 7th Edition, McGraw Hill
2. **Ramez Elmasri, Shamkant B. Navathe** – ***Fundamentals of Database Systems***, 7th Edition, Pearson Education

Reference Books:

1. **C.J. Date** – ***An Introduction to Database Systems***, 8th Edition, Addison-Wesley
2. **Raghu Ramakrishnan, Johannes Gehrke** – ***Database Management Systems***, 3rd Edition, McGraw Hill
3. **Pramod J. Sadalage & Martin Fowler** – ***NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence***, Pearson

Online Resources & Courses:

1. **NPTEL – Database Management Systems by IIT Madras**
2. **Coursera – Databases by Stanford University**
3. **Khan Academy – Intro to SQL**
4. **MongoDB University – Free Courses on NoSQL Databases**
5. **W3Schools SQL Tutorial**
6. **GeeksforGeeks – DBMS Concepts and Practice Problems**

IV B.Tech-I Sem

23A38502	**CYBER SECURITY** **(Open Elective-III)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

1. To introduce the concept of cybercrime and its impact on information security, and provide an overview of cybercriminal behavior and various classifications of cybercrimes.
2. To explore the methodologies used by cybercriminals to plan and execute attacks, including techniques like social engineering, botnets, and cloud-related threats.
3. To understand the security risks associated with mobile and wireless devices, and examine countermeasures for securing mobile computing in organizational environments.
4. To familiarize students with the tools and techniques used in committing cybercrimes, such as phishing, malware, DoS/DDoS attacks, and code-based exploits.
5. To analyze the implications of cybercrime for organizations, including the cost of cyber attacks, intellectual property issues, and challenges posed by social computing and web-based threats.

Course Outcomes:

After completion of the course, students will be able to

1. Understand the fundamentals of cybercrime and information security, and explain the legal and global perspectives, especially with reference to Indian IT Act 2000.
2. Analyze how cybercriminals plan and execute cyber offenses using techniques like social engineering, cyber stalking, and botnets, including threats posed by cloud computing.
3. Evaluate the security challenges of mobile and wireless devices and formulate measures to secure mobile environments within an organization.
4. Identify and explain various cyber attack tools and methods such as phishing, keyloggers, Trojans, and SQL injection used in committing cybercrimes.
5. Assess the organizational implications of cybercrimes, including IPR issues, social media risks, and formulate strategies to mitigate security and privacy challenges.

UNIT I Introduction to Cybercrime

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT II Cyber Offenses: How Criminals Plan Them

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

UNIT III Cybercrime: Mobile and Wireless Devices

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices,

Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones,

Mobile Devices:

Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies an Measures in Mobile Computing Era, Laptops.

UNIT IV Tools and Methods Used in Cybercrime

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT V Cyber Security: Organizational Implications

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Textbooks:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J.DavidIrwin.CRC Press T&F Group

Online Learning Resources:

http://nptel.ac.in/courses/106105031/40

http://nptel.ac.in/courses/106105031/39

http://nptel.ac.in/courses/106105031/38

IV B.Tech I Sem

23A54701	**WAVELET TRANSFORMS AND ITS APPLICATIONS (Open Elective-III)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms	L2, L3
CO2	Illustrate the multi resolution analysis ad scaling functions	L3, L5
CO3	Implement discrete wavelet transforms with multirate digital filters	L3
CO4	Understand multi resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.	L2, L3
CO5	Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields	L3,L5

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	-	-	-	-	-	-	-	1
CO2	3	2	2	2	-	-	-	-	-	-	-	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1

1-Slightly, 2-Moderately, 3-Substantially.

UNIT – I: Wavelets (08)

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete-Time and Continuous Wavelet Transforms.

UNIT – II: A Multiresolution Formulation of Wavelet Systems (08)

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT – III Filter Banks and the Discrete Wavelet Transform (08)

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating - Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.

UNIT – IV Time-Frequency and Complexity (08)

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

UNIT-V Bases and Matrix Examples (08)

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

TEXT BOOK:

1. C. Sidney Burrus, Ramesh A. Gopinath, "Introduction to Wavelets and Wavelets Transforms", Prentice Hall, (1997).
2. James S. Walker, "A Primer on Wavelets and their Scientific Applications", CRC Press, (1999)..

REFERENCES:

1. RaghuveerRao, "Wavelet Transforms", Pearson Education, Asia
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.

1. http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html
2. http://www.wavelet.org/
3. http://www.math.hawaii.edu/~dave/Web/Amara's%20Wavelet%20Page.htm
4. https://jqichina.wordpress.com/wp-content/uploads/2012/02/ten-lectures-of-waveletsefbc88e5b08fe6b3a2e58d81e8aeb2efbc891.pdf

IV B.Tech I Sem

23A56701a	**SMART MATERIALS AND DEVICES** (Common to all branches) **Open Elective-III**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

	Course Objectives
1	To provide exposure to smart materials and their engineering applications.
2	To impart knowledge on the basics and phenomenon behind the working of smart materials
3	To explain the properties exhibited by smart materials
4	To educate various techniques used to synthesize and characterize smart materials
5	To identify the required smart material for distinct applications/devices

Syllabus:

UNIT I Introduction to Smart Materials **9H**

Historical account of the discovery and development of smart materials, Shape memory materials, chromoactive materials, magnetorheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT II Properties of Smart Materials **9H**

Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT III Synthesis of Smart Materials **9H**

Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT IV Characterization Techniques **9H**

Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT V Smart Materials based Devices **9H**

Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Textbooks:

1. YaserDahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2017

2. E. Zschech,C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

Reference Books:

1. Gauenzi,P.,Smart Structures, Wiley, 2009.

2. MahmoodAliofkhazraei, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014

3. **Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0,**Chaudhery

MustansarHussain, Paolo Di Sia, Springer,2022.

4.**Fundamentals of Smart Materials,**Mohsen Shahinpoor, Royal Society of Chemistry, 2020

NPTEL course link: https://onlinecourses.nptel.ac.in/noc22_me17/preview

	Course Outcomes	**Blooms Level**
CO1	Identify key discoveries that led to modern applications of shape memory materials, describe the two phases in shape memory alloys.	L1,L2, L3, L4
CO2	Describe how different external stimuli (light, electricity, heat, stress, and magnetism) influence smart material properties.	L1,L2, L3
CO3	Summarize various types of synthesis of smart materials	L1,L2, L3
CO4	Analyze various characterization techniques used for smart materials	L1,L2, L3
CO5	Interpret the importance of smart materials in various devices	L1,L2

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1							
CO2	3	3	2	1	1							
CO3	3	3	1	1	1							
CO4	3	2	1	1	1							
CO5	3	3	1	1	-							

1-Slightly, 2-Moderately, 3-Substantially.

23A56701b	INTRODUCTON TO QUANTUM MECHANICS Open Elective – III	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES	
1	To understand the fundamental differences between classical and quantum mechanics.
2	To study wave-particle duality, uncertainty principle, and their implications.
3	To learn and apply Schrödinger equations to basic quantum systems.
4	To use operator formalism and mathematical tools in quantum mechanics.
5	To explore angular momentum, spin and their quantum mechanical representations.

UNIT- I: PRINCIPLES OF QUANTUM MECHANICS

Introduction: Limitations of classical Mechanics, Difficulties with classical theories of black body radiation and origin of quantum theory of radiation.Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle.Schrödinger time independent and time dependent wave equation, Solution of the time dependent Schrödinger equation, Concept of stationary states, Physical significance of wave function (ψ), Orthogonal, Normalized and Orthonormal functions

UNIT- II: ONE DIMENSIONAL PROBLEMS AND SOLUTIONS

Potential step – Reflection and Transmission at the interface. Potential well: Square well potential with rigid walls, Square well potential with finite walls. Potential barrier: Penetration of a potential barrier (tunneling effect). Periodic potential and Harmonic oscillator, Energy eigen functions and eigen values.

UNIT-III: OPERATOR FORMALISM

Operators, Operator Algebra, Eigen values and Eigen vectors, Postulates of quantum mechanics, Matrix representation of wave functions and linear operators.

UNIT- IV: MATHEMATICAL TOOLS FOR QUANTUM MECHANICS

The concept of row and column matrices, Matrix algebra,Hermitian operators – definition. Dirac's bra and ket notation, Expectation values, Heisenberg (operator) representation of harmonic oscillator, Ladder operators and their significance.

UNIT- V : ANGULAR MOMENTUM AND SPIN

Angular momentum operators: Definition. Eigen functions and Eigen values of AM operators. Matrix representation of angular momentum operators, System with spin half(1/2), Spin angular momentum, Pauli's spin matrices. Clebsch-Gordon coefficients. Rigid Rotator: Eigen functions and Eigen values.

BOOKS FOR STUDY:

1. Quantum Mechanics. Vol 1, A. MessaiaNoth-Holland Pub. Co., Amsterdam,(1961).
2. A Text Book of Quantum Mechanics. P.M.Mathews and K.Venkatesam, Tata McGraw Hill, New Delhi,(1976).
3. Introduction to Quantum Mechanics. R.H.Dicke and J.P.Witke, Addison-Wisley Pub.Co.Inc.,London, (1960).
4. Quantum Mechanics. S.L.Gupta, V.Kumar, H.V.Sarama and R.C.Sharma, Jai PrakashNath& Co, Meerut, (1996).

REFERENCE BOOKS:

1. Quantum Mechanics. L.I. Schiff, McGraw Hill Book Co., Tokyo, (1968).
2. Introduction to Quantum Mechanics. Richard L. Liboff, Pearson Education Ltd (Fourth Edn.) 2003.

	CourseOutcomes After completing this course, students will be able to:	**Blooms Level**
CO1	Explain the key principles of quantum mechanics and wave-particle duality	L1, L2
CO2	Apply Schrödinger equations to solve one-dimensional quantum problems	L3, L4
CO3	Solve quantum mechanical problems using operator and matrix methods.	L2, L4
CO4	Evaluate quantum states using Dirac notation and expectation values.	L5
CO5	Analyze angular momentum and spin systems using Pauli matrices and operators.	L4, L5

NPTEL courses link :

4. **https://archive.nptel.ac.in/courses/115/101/115101107/**
5. **https://archive.nptel.ac.in/courses/122/106/122106034/**
6. **https://nptel.ac.in/courses/115106066**

CourseArticulationMatrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	2							
CO2	3	2	2	1	1							
CO3	3	3	2	1	1							

CO4	3	3	3	2	3							
CO5	3	3	1	1	1							

1-Slightly, 2-Moderately, 3-Substantially.

IV B.Tech I Sem

		L	T	P	C
23A51701	**GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT** (Common to all branches) **Open Elective-III**	**3**	**0**	**0**	**3**

Course Objectives	
1	To understand principle and concepts of green chemistry.
2	To understand the types of catalysis and industrial applications.
3	To apply green solvents in chemical synthesis.
4	To enumerate different sourced of green energy.
5	To apply alternative greener methods foe chemical reactions

Course Outcomes	
CO1	Apply the Green chemistry Principles for day to day life as well as synthesis, describe the sustainable development and green chemistry, Explain economic and un-economic reactions, Demonstrate Polymer recycling.
CO2	Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries, Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis, Discuss Transition metal and Phase transfer Catalysis
CO3	Demonstrate Green solvents and importance, Discuss Supercritical carbondioxide, Explain Supercritical water, recycling of green solvents.
CO4	Describe importance of Biomass and Solar Power, Illustrate Sonochemistry, Apply Green Chemistry for Sustainable Development; discuss the importance of Renewable resources, mechanochemical synthesis.
CO5	Discuss Alternative green methods like Photoredox catalysis, single electron transfer reactions (SET), Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

UNIT 1: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling

UNIT 2: CATALYSIS AND GREEN CHEMISTRY

Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio-catalysis and Photo-catalysis with examples.

UNIT 3: GREEN SOLVENTS IN CHEMICAL SYNTHESIS

Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethylene glycol (PEG), Ionic liquids, Recyling of green solvents.

UNIT 4: EMERGING GREENER TECHNOLOGIES

Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock's, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, Mechanochemical synthesis.

UNIT 5: ALTERNATIVE GREENER METHODS

Photochemical Reactions - Examples, Advantages and Challenges, Photoredox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Text Books :

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

References :

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

IV B.Tech I Sem

23A52703	**EMPLOYABILITY SKILLS** **OPEN ELECTIVE-III**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To encourage all round development of the students by focusing on productive skills
- To make the students aware of Goal setting and writing skills
- To enable them to know the importance of presentation skills in achieving desired goals.
- To help them develop organizational skills through group activities

To function effectively with heterogeneous teams

Course Outcomes (CO):	**Blooms Level**
CO1: Understand the importance of goals and try to achieve them	L1, L2
CO2: Explain the significance of self-management	L1, L2
CO3: Apply the knowledge of writing skills in preparing eye-catchy resumes	L3
CO4: Analyse various forms of Presentation skills	L4
CO5: Judge the group behaviour appropriately	L5
CO6: Develop skills required for employability.	L3, L6

UNIT - I	**Goal Setting and Self-Management**	Lecture Hrs

Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis

UNIT - II	**Writing Skills**	Lecture Hrs

Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose)

UNIT - III	**Technical Presentation Skills**	Lecture Hrs

Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation

UNIT - IV	**Group Presentation Skills**	Lecture Hrs

Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion-Debate –Corporate Etiquette

UNIT - V	**Job Cracking Skills**	Lecture Hrs

Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success –

Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews

Textbooks:

1. Sabina Pillai, Agna Fernandez. *Soft Skills & Employability Skills***,**2014.Cambridge Publisher.
2. Alka Wadkar. Life Skills for Success, Sage Publications, 2016.

Reference Books:

1. Gangadhar Joshi. Campus to Corporate Paperback , Sage Publications. 2015
2. Sherfield Montogomery Moody,Cornerstone Developing Soft Skills, Pearson Publications. 4 Ed. 2008
3. Shikha Kapoor. *Personality Development and Soft Skills - Preparing for Tomorrow* .1 Edition, Wiley, 2017.
4. M. Sen Gupta, *Skills for Employability*, Innovative Publication, 2019.
5. Steve Duck and David T McMahan***,*** *The Basics f Communication Skills A Relational Perspective*, Sage press, 2012.

Online Learning Resources:

1. https://youtu.be/gkLsn4ddmTs
2. https://youtu.be/2bf9K2rRWwo
3. https://youtu.be/FchfE3c2jzc
4. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
5. https://www.youtube.com/c/skillopedia/videos
6. https://onlinecourses.nptel.ac.in/noc25_hs96/preview
7. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
8. https://archive.nptel.ac.in/courses/109/107/109107172/#
9. https://archive.nptel.ac.in/courses/109/104/109104107/

CIVIL ENGINEERING					
IV B.Tech – I Semester					
23A01705a	**GEO-SPATIAL TECHNOLOGIES (OPEN ELECTIVE – IV)**	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
2. To analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
3. To apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
4. To evaluate surface andgeostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
5. To assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Understand raster-based spatial analysis techniques, including query, overlay, and cost-distance analysis.
2. Analyze vector-based spatial analysis techniques such as topology, overlay, and proximity analysis.
3. Apply network analysis techniques for geocoding, shortest path analysis, and location-allocation problems.
4. Evaluate surface andgeostatistical analysis methods, including terrain modeling, watershed analysis, and spatial interpolation.
5. Assess GIS customization, Web GIS, and mobile mapping techniques for real-world applications.

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	2	-	-	-	-	-	-	-	3	3

CO -2	3	3	-	-	2	-	-	-	-	-	-	2	3	3
CO -3	3	-	3	2	3	-	-	-	-	-	-	-	3	3
CO -4	-	-	3	3	3	-	2	-	-	-	-	-	3	3
CO -5	-	-	-	-	3	3	3	2	-	-	-	-	3	3

UNIT – I

RASTER ANALYSIS

Raster Data Exploration: Query Analysis - Local Operations: Map Algebra, Reclassification, Logical and Arithmetic Overlay Operations—Neighborhood - Operations: Aggregation, Filtering – Extended Neighborhood-Operations- Zonal Operations - Statistical Analysis – Cost-Distance Analysis-Least Cost Path.

UNIT – II

VECTOR ANALYSIS

Non-Topological Analysis: Attribute Database Query, Structured Query Language, Co-Ordinate Transformation, Summary Statistics, Calculation of Area, Perimeter and Distance – topological Analysis: Reclassification, Aggregation, Overlay Analysis: Point-In-Polygon, Line-In-Polygon, Polygon-On-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering

UNIT – III

NETWORK ANALYSIS

Network – Introduction - Network Data Model – Elements of Network - Building A Network Database - Geocoding – Address Matching - Shortest Path in A Network – Time and Distance Based Shortest Path Analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis

UNIT – IV

SURFACE and GEOSTATISTICAL ANALYSIS

Surface Data – Sources of X,Y, Z Data – DEM, TIN – Terrain Analysis – Slope, Aspect, Viewshed, Watershed Analysis: Watershed Boundary, Flow Direction, Flow Accumulation, Drainage Network, Spatial Interpolation: IDW, Spline, Kriging, Variogram.

UNIT – V

CUSTOMISATION, WEB GIS, MOBILE MAPPING

Customisation of GIS: Need, Uses, Scripting Languages –Embedded Scripts – Use of Python Script - Web GIS: Web GIS Architecture, Advantages of Web GIS, Web Applications- Location Based Services: Emergency and Business Solutions - Big Data Analytics.

TEXT BOOKS:

1. Kang – Tsung Chang, Introduction to Geographical Information System, 4th Ed., Tata McGraw Hill Edition, 2008.
2. Lo, C.P. andYeung, Albert K.W., Concepts and Techniques of Geographic Information Systems Prentice Hall, 2002.

REFRENCE BOOKS:

1. Michael N. Demers, Fundamentals of Geographic Information Systems, Wiley,2009
2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasaraju, "An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
3. John Peter Wilson, The Handbook of Geographic Information Science, Blackwell Pub.,2008

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/105/105105202/

https://onlinecourses.nptel.ac.in/noc19_cs76/preview

CIVIL ENGINEERING

IV B.Tech – I Semester

23A01705b	**SOLID WASTE MANAGEMENT (OE – IV)**	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course are to make the student :

1. To understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
2. To analyze engineering systems for solid waste collection, storage, and transportation.
3. To apply resource and energy recovery techniques for sustainable solid waste management.
4. To evaluate landfill design, construction, and environmental impact mitigation strategies.
5. To assess hazardous waste management techniques, including biomedical and e-waste disposal.

Course Outcomes:

1. Understand the types, sources, and characteristics of solid waste, along with regulatory frameworks.
2. Analyze engineering systems for solid waste collection, storage, and transportation.
3. Apply resource and energy recovery techniques for sustainable solid waste management.
4. Evaluate landfill design, construction, and environmental impact mitigation strategies.
5. Assess hazardous waste management techniques, including biomedical and e-waste

CO – PO Articulation Matrix

Course Outcomes	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO -1	3	-	-	-	2	-	2	-	-	-	-	-	3	3
CO -2	3	3	-	-	2	-	3	-	-	-	-	2	3	3
CO -3	3	-	3	2	3	-	3	-	-	-	-	-	3	3
CO -4	-	-	3	3	3	-	3	2	-	-	-	-	3	3
CO -5	-	-	-	-	3	3	3	3	-	-	-	-	3	3

UNIT – I		
Solid Waste: Definitions, Types of Solid Wastes, Sources of Solid Wastes, Characteristics, and Perspectives; Properties of Solid Wastes, Sampling of Solid Wastes, Elements of Solid Waste Management - Integrated Solid Waste Management, Solid Waste Management Rules 2016.		
UNIT – II		
Engineering SystemsforSolid Waste Management: Solid Waste Generation; On-Site Handling, Storage and Processing; Collection of Solid Wastes; Stationary Container System and Hauled Container Systems – Route Planning - Transfer and Transport; Processing Techniques;		
UNIT – III		
Engineering Systems for Resource and Energy Recovery: Processing Techniques; Materials Recovery Systems; Recovery of Biological Conversion Products – Composting, Pre and Post Processing, Types of Composting, Critical Parameters, Problems With Composing - Recovery of Thermal Conversion Products; Pyrolisis, Gasification, RDF - Recovery of Energy From Conversion Products; Materials and Energy Recovery Systems.		
UNIT – IV		
Landfills: Evolution of Landfills – Types and Construction of Landfills – Design Considerations – Life of Landfills- Landfill Problems – Lining of Landfills – Types of Liners – Leachate Pollution and Control – Monitoring Landfills – Landfills Reclamation.		
UNIT – V		
Hazardous Waste Management: – Sources and Characteristics, Effects On Environment, Risk Assessment – Disposal of Hazardous Wastes – Secured Landfills, Incineration - Monitoring – Biomedical Waste Disposal, E-Waste Management, Nuclear Wastes, Industrial Waste Management		
TEXT BOOKS:		
1. Tchobanoglous G, Theisen H and Vigil SA 'Integrated Solid Waste Management, Engineering Principles and Management Issues' McGraw-Hill, 1993. 2. Vesilind PA, Worrell W and Reinhart D, 'Solid Waste Engineering' Brooks/Cole Thomson Learning Inc., 2002.		
REFRENCE BOOKS:		
1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, 'Environmental Engineering', McGraw		

Hill Inc., New York, 1985.
2. Qian X, Koerner RM and Gray DH, 'Geotechnical Aspects of Landfill Design and Construction' Prentice Hall, 2002.

Online Learning Resources:

https://archive.nptel.ac.in/courses/105/103/105103205/

https://archive.nptel.ac.in/courses/120/108/120108005/

IV B.Tech I Sem

23A02705	**ELECTRIC VEHICLES**	**L**	**T**	**P**	**C**
	(Open Elective -IV)	**3**	**0**	**0**	**3**

Course Objectives: To make the student

- Remember and understand the differences between conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs.
- Analyze various EV configurations, parameters of EV systems and Electric vehicle dynamics.
- Analyze the basic construction, operation and characteristics of fuel cells and battery charging techniques in HEV systems.
- Design and analyze the various control structures for Electric vehicle.

Course Outcomes (CO): Student will be able to

CO 1: To understand and differentiate between Conventional Vehicle and Electric Vehicles, electro mobility and environmental issues of EVs. -L2

CO 2: Understand Various dynamics of Electric Vehicles. -L2

CO 3: To remember and understand various configurations in parameters of EV system and dynamic aspects of EV. -L1

CO 4: To analyze fuel cell technologies in EV and HEV systems. -L3

CO 5: To analyze the battery charging and controls required of EVs. -L3

UNIT I Introduction to EV Systems and Energy Sources:

Past, Present and Future of EV - EV Concept- EV Technology- State-of-the Art of EVs- EV configuration- EV system- Fixed and Variable gearing- Single and multiple motor drive- In-wheel drives- EV parameters: Weight, size, force and energy, performance parameters. Electro mobility and the environment- History of Electric power trains- Carbon emissions from fuels- Green houses and pollutants- Comparison of conventional, battery, hybrid and fuel cell electric systems.

UNIT II EV Propulsion and Dynamics:

Choice of electric propulsion system- Block diagram- Concept of EV Motors- Single and multi-motor configurations- Fixed and variable geared transmission- In-wheel motor configuration- Classification - Electric motors used in current vehicle applications - Recent EV Motors- Vehicle load factors- Vehicle acceleration.

UNIT III Fuel Cells:

Introduction of fuel cells- Basic operation- Model - Voltage, power and efficiency- Power plant system – Characteristics- Sizing - Example of fuel cell electric vehicle - Introduction to HEV- Brake specific fuel consumption - Comparison of Series-Parallel hybrid systems- Examples.

UNIT IV Battery Charging and Control:

Battery charging: Basic requirements- Charger architecture- Charger functions- Wireless charging- Power factor correction.

Control: Introduction- Modeling of electro mechanical system- Feedback controller design approach- PI controller's designing- Torque-loop, Speed control loop compensation- Acceleration of battery electric vehicle.

UNIT V Energy Storage Technologies:

Role of Energy Storage Systems- Thermal- Mechanical-Chemical- Electrochemical- Electrical - Efficiency of energy storage systems- Super capacitors-Superconducting Magnetic Energy Storage (SMES)- SOC- SoH -fuel cells - G2V- V2G- Energy storage in Micro-grid and Smart grid- Energy Management with storage systems- Battery SCADA

Textbooks:

1.C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001,1st Edition

2.Ali Emadi, "Advanced Electric Drive Vehicles", CRC Press, 2017,1st Edition

Reference Books:

1.Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2021, 3rd Edition.

2.Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt," Energy Storage in Power Systems" Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016,1st Edition

3.A.G.Ter-Gazarian, "Energy Storage for Power Systems", the Institution of Engineering and Technology (IET) Publication, UK, (ISBN – 978-1-84919-219-4), Second Edition, 2011.

4.Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, "Modern Elelctric, Hybrid Elelctric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2004,1st Edition

5.James Larminie, John Lowry, "Electric Vehicle Technology Explained", Wiley, 2003,2nd Edition.

Online Learning Resources:

1. https://nptel.ac.in/courses/108/102/108102121/
2. https://nptel.ac.in/syllabus/108103009

IV B.Tech I Sem

23A03705	**TOTAL QUALITY MANAGEMENT (Open Elective-IV).**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives: The objectives of the course are to	
1	Familiarize the basic concepts of Total Quality Management.
2	Expose with various quality issues in Inspection.
3	Gain Knowledge on quality control and its applications to real time..
4	Understand the extent of customer satisfaction by the application of various quality concepts.
5	Demonstrate the importance of Quality standards in Production

Course Outcomes: On successful completion of the course, the student will be able to,		
1	Define and develop on quality Management philosophies and analyze quality costs frameworks.	L1,L3,L4
2	Understanding of the historical development of Total Quality Management (TQM), implementation, and real-world applications through case studies.	L2, L3,L6
3	Evaluate the cost of poor quality, process effectiveness and efficiency to analyze areas for improvement.	L2,L4,L5
4	Apply benchmarking and business process reengineering to improve management processes.	L3,L5,L6
5	Demonstrate the set of indications to evaluate performance excellence of an organization	L1,L2,L5

UNIT – I Introduction:

Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

UNIT - II Historical Review:

Historical Review: Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

UNIT – III TQM Principles:

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures Basic Concepts, Strategy, Performance Measure Case studies.

UNIT - IV TQM Tools:

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

UNIT – V Quality Systems:

Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Text Books:

1.Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.

2.Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.

3.Joel E.Ross , Total Quality Management, Third Eition, CRC Press, 2017.

Reference Books:

1.Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.

2.Robert L.Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.

3.Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh Edition, Tata Mcgraw Hill, 2015

4.Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995.

Online Learning Resources:

- https://www.youtube.com/watch?v=VD6tXadibk0
- https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
- https://blog.capterra.com/what-is-total-quality-management/
- https://nptel.ac.in/courses/110/104/110104080/

- https://onlinecourses.nptel.ac.in/noc21_mg03/preview
- https://nptel.ac.in/courses/110/104/110104085/
- https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

IV B.Tech I Sem

		L	T	P	C
23A05502T	**INTRODUCTION TO COMPUTER NETWORKS** **(Open Elective-IV)**	**3**	**0**	**0**	**3**

Course Objectives:

The course is designed to:

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Expose the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Familiarize with the applications of Internet
- Elucidate the design issues for a computer network

Course Outcomes:

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

- Identify the software and hardware components of a computer network
- Design software for a computer network
- Develop error, routing, and congestion control algorithms
- Assess critically the existing routing protocols
- Explain the functionality of each layer of a computer network
- Choose the appropriate transport protocol based on the application requirements

UNIT I:

Computer Networks and the Internet **Lecture: 8 Hrs**

What Is the Internet? Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks (Textbook 2), Reference Models, Multimedia Networks, Guided Transmission Media, Wireless Transmission (Textbook 1)

UNIT II:

The Data Link Layer, Access Networks, and LANs **Lecture: 10 Hrs**

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols (Textbook 1) Introduction to the Link Layer, Error-Detection and -Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks, Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page (Packet) (Textbook 2)

UNIT III:

The Network Layer **Lecture: 8 Hrs**
Routing Algorithms, Internetworking, The Network Layer in The Internet (Textbook 1)

UNIT IV:

The Transport Layer **Lecture: 9 Hrs**
Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

UNIT V:

The Application Layer **Lecture: 8 Hrs**
Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications, Video Streaming and Content Distribution Networks (Textbook 2)

Textbooks:

1. Andrew S. Tanenbaum, David J. Wetherall, *Computer Networks*, 6th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, *Computer Networking: A Top-Down Approach*, 6th Edition, Pearson, 2019.

Reference Books:

1. Forouzan, *Data Communications and Networking*, 5th Edition, McGraw Hill Publication.
2. Youlu Zheng, Shakil Akhtar, *Networks for Computer Scientists and Engineers*, Oxford Publishers, 2016.

Online Learning Resources:

1. https://nptel.ac.in/courses/106105183/25
2. https://www.nptelvideos.in/2012/11/computer-networks.html
3. https://nptel.ac.in/courses/106105183/3

IV B.Tech I Sem

23A35501T	**INTERNET OF THINGS (Open Elective-IV)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Understand the basics of Internet of Things and protocols.
- Discuss the requirement of IoT technology
- Introduce some of the application areas where IoT can be applied.
- Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management

Course Outcomes:

After completion of the course, students will be able to

- Understand general concepts of Internet of Things.
- Apply design concept to IoT solutions
- Analyze various M2M and IoT architectures
- Evaluate design issues in IoT applications
- Create IoT solutions using sensors, actuators and Devices

UNIT I Introduction to IoT

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT II Prototyping IoT Objects using Microprocessor/Microcontroller

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT III IoT Architecture and Protocols

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT IV Device Discovery and Cloud Services for IoT

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT V UAV IoT

Introduction toUnmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Textbooks:

1. Vijay Madisetti and ArshdeepBahga, " Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis;George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, " From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 9781-4493- 9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning Resources:

1. *https://www.arduino.cc/*
2. *https://www.raspberrypi.org/*
3. *https://nptel.ac.in/courses/106105166/5*
4. *https://nptel.ac.in/courses/108108098/*4

23A32603	**INTRODUCTION TO QUANTUM COMPUTING** **Open Elective – IV**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the principles and mathematical foundations of quantum computation.
- To understand quantum gates, circuits, and computation models.
- To explore quantum algorithms and their advantages over classical ones.
- To develop the ability to simulate and write basic quantum programs.
- To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.

Course Outcomes:

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

- Explain the fundamental concepts of quantum mechanics used in computing.
- Construct and analyze quantum circuits using standard gates.
- Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
- Develop simple quantum programs using Qiskit or similar platforms.
- Analyze applications and challenges of quantum computing in real-world domains.

UNIT I: Fundamentals of Quantum Mechanics and Linear Algebra

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT II: Quantum Gates and Circuits

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT III: Quantum Algorithms and Complexity

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT IV: Quantum Programming and Simulation Platforms

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT V: Applications and Future of Quantum Computing

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Textbooks:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

Online Learning Resources:

1. IBM Quantum Experience and Qiskit Tutorials
2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley
3. edX – The Quantum Internet and Quantum Computers
4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

IV B.Tech I Sem

23A54702	**FINANCIAL MATHEMATICS (Open Elective-IV)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

1. To provide mathematical foundations for financial modelling, risk assessment and asset pricing.
2. To introduce stochastic models and their applications in pricing derivatives and interest rate modelling.
3. To develop analytical skills for fixed-income securities, credit risk, and investment strategies.
4. To equip students with computational techniques for pricing financial derivatives.

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	**Statements**	**Blooms level**
CO1	Explain fundamental financial concepts, including arbitrage, valuation, and risk.	L2 (Understand)
CO2	Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts.	L3 (Apply)
CO3	Analyze mathematical techniques for pricing options and financial derivatives.	L4 (Analyze)
CO4	Evaluate interest rate models and bond pricing methodologies.	L5 (Evaluate)
CO5	Utilize computational techniques such as Monte Carlo simulations for financial modeling.	L3 (Apply)

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	1	-	-	-	-	-	2	1

CO2	3	3	2	2	2	-	-	-	-	-	1	1
CO3	3	3	3	3	2	1	-	-	-	-	3	2
CO4	3	3	3	3	1	-	-	-	-	-	2	1
CO5	3	3	3	3	3	-	-	-	-	-	2	2

• **3** = Strong Mapping, **2** = Moderate Mapping, **1** = Slight Mapping, **-** = No Mapping

UNIT-I: Asset Pricing and Risk Management (08)

Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

UNIT-II: Stochastic Models in Finance (08)

Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito's Lemma, Ito Integral, and Ito Isometry.

UNIT-III: Interest Rate and Credit Modelling (08)

Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR), Hull & White models, Credit risk modelling: Hazard function and hazard rate.

UNIT-IV: Fixed-Income Securities and Bond Pricing (08)

Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.

UNIT-V: Exotic Options and Computational Finance (08)

Stochastic volatility models and the Feynman-Kac theorem.Exotic options: Barriers, Asians, and Look backs. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

Textbooks:

1. Ales Cerny, *Mathematical Techniques in Finance: Tools for Incomplete Markets,* Princeton University Press.
2. S.R. Pliska, *Introduction to Mathematical Finance: Discrete-Time Models*, Cambridge University Press.

Reference Books:

1. IoannisKaratzas& Steven E. Shreve, *Methods of Mathematical Finance*, Springer, New York.

2. John C. Hull, *Options, Futures, and Other Derivatives*, Pearson.

Web References:

- MIT– Mathematics for Machine Learning https://ocw.mit.edu
- Coursera – Financial Engineering and Risk Management (Columbia University) https://www.coursera.org/
- National Stock Exchange (NSE) India – Financial Derivatives https://www.nseindia.com/

IV B.Tech I Sem

		L	T	P	C
23A56702	**SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS** **(Open Elective-IV)** (Common to all branches)	**3**	**0**	**0**	**3**

COURSE OBJECTIVES	
1	To provide exposure to various kinds of sensors and actuators and their engineering applications.
2	To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
3	To explain the operating principles of various sensors and actuators
4	To educate the fabrication of sensors
5	To explain the required sensor and actuator for interdisciplinary application

UNIT I Introduction to Sensors and Actuators 9H

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT II Temperature and Mechanical Sensors 9H

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT III Optical and Acoustic Sensors 9H

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones

UNIT IV Magnetic and Electromagnetic Sensors 9H

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT V Chemical and Radiation Sensors 9H

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Textbooks:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015

2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

Reference Books:

1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003

2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999

3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.

4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

NPTEL course link: https://onlinecourses.nptel.ac.in/noc21_ee32/preview

	Course Outcomes	**Blooms Level**
CO1	Classify different types of Sensors and Actuators along with their characteristics	L1,L2
CO2	Summarize various types of Temperature and Mechanical sensors	L1,L2
CO3	Illustrates various types of optical and mechanical sensors	L1,L2
CO4	Analyze various types of Optical and Acoustic Sensors	L1,L2, L3
CO5	Interpret the importance of smart materials in various devices	L1,L2

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	3	2	2	1							
CO2	3	3	2	1	1							
CO3	3	3	1	1	1							
CO4	3	2	1	1	-							
CO5	3	3	1	1	-							

1-Slightly, 2-Moderately, 3-Substantially.

IV B.Tech I Sem

		L	T	P	C
23A51702	**CHEMISTRY OF NANOMATERIALS AND APPLICATIONS** **(Open Elective-IV)**	3	0	0	3

Course Objectives	
1	To understand basics and characterization of nanomaterials.
2	To understand synthetic methods of nanomatrials.
3	To apply various techniques for charterization of nanomaterials.
4	To understand Studies of Nano-structured Materials
5	To enumerate the applications of advanced nanomaterials in engineering

Course Outcomes	
CO1	Classify the nanostructure materials; describe scope of nanoscience and importance technology.
CO2	Describe the top-down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapor deposition method and electrode position method, Discuss about highenergy ball milling.
CO3	Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis.
CO4	Explain synthesis and properties and applications of nanaomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, nonlinear optical materials.
CO5	Illustrate advance engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

Mapping between Course Outcomes and Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												

Unit – I

Basics and Characterization of Nanomaterials: Introduction**,** Scope of nanoscience and nanotecnology, nanoscience in nature, classification of nanostructured materials, importance of nanomaterials.

Unit – II

Synthesis of nanomaterials : Top-Down approach**,** Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, highenergy ball milling method.

Synthetic Methods**:** Bottom-Up approach**,** Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT-III

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

UNIT-IV

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

UNIT-V

Advanced Engineering Applications of Nanomaterials: Applications of Nano Particle, nanorods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

TEXT BOOKS:

1. **NANO: The Essentials:** T Pradeep, MaGraw-Hill, 2007.
2. **Textbook of Nanoscience and nanotechnology:** B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; LudovicoCademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Wiley-VCH, 2011.
2. **Nanostructures &Nanomaterials; Synthesis, Properties & Applications:** Guozhong Cao, Imperial College Press, 2007.

IV B.Tech I Sem

23A52704	**LITERARY VIBES** **(Open Elective-IV)** (Common to all branches)	**L**	**T**	**P**	**C**

Course Objectives	
1	To inculcate passion for aesthetic sense and reading skills
2	To encourage respecting others' experiences and creative writing
3	To explore emotions, communication skills and critical thinking
4	To educate how books serve as the reflection of history and society
5	To provide practical wisdom and duty of responding to events of the times

Course Outcomes		**Blooms Level**
CO1	Identify genres, literary techniques and creative uses of language in literary texts.	L1, L2
CO2	Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces	L1, L2
CO3	Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments	L3
CO4	Analyze the underlying meanings of the text by using the elements of literary texts	L4
CO5	Evaluate their own work and that of others critically	L5
CO6	Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance	L3

UNIT I: Poetry

1. Ulysses- Alfred Lord Tennyson
2. Ain't I woman?-Sojourner Truth
3. The Second Coming-W.B. Yeats
4. Where the Mind is Without Fear-Rabindranath Tagore

UNIT II: Drama: *Twelfth Night*- William Shakespeare

1. Shakespeare -life and works
1. Plot & sub-plot and Historical background of the play
2. Themes and Criticism
3. Style and literary elements
4. Characters and characterization

UNIT III: Short Story

1. The Luncheon - Somerset Maugham
2. The Happy Prince-Oscar Wild
3. Three Questions – Leo Tolstoy
4. Grief –Antony Chekov

UNIT IV: Prose: Essay and Autobiography

1. My struggle for an Education-Booker T Washington
2. The Essentials of Education-Richard Livingston
3. The story of My Life-Helen Keller
4. Student Mobs-JB Priestly

UNIT V: Novel: *Hard Times*- Charles Dickens

1. Charles Dickens-Life and works
2. Plot and Historical background of the novel
3. Themes and criticism
4. Style and literary elements
5. Characters and characterization

Text Books:

1. Charles Dickens**.***Hard Times.*(Sangam Abridged Texts) Vantage Press, 1983
2. DENT JC.William Shakespeare. Twelfth Night**.** Oxford University Press,2016.

References:

1. WJ Long.*History of English Literature***,** Rupa Publications India; First Edition (4 October 2015)
2. RK Kaushik And SC Bhatia. Essays, Short Stories and One Act Plays, Oxford University Press .2018.

3. Dhanvel, SP. *English and Soft Skills*, Orient Blackswan,2017.
4. *New Horizon*, Pearson publications, New Delhi 2014
5. Vimala Ramarao, *Explorations Volume*-II, Prasaranga Bangalore University,2014**.**
6. Dev Neira, Anjana & Co. *Creative Writing: A Beginner's Manual.*Pearson India, 2008.

Online Resources

https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses

https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis

https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis-summary-and-line-by-line-explanation/#google_vignette

https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/

https://www.litcharts.com/lit/twelfth-night/themes

https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/

HONOURS

23A04H01	ANALOG IC DESIGN Honors with VLSI specialization	L	T	P	C
		3	0	0	3

Course Objectives:

1. To explore MOSFET characteristics, biasing techniques and current mirrors for analog circuit design.
2. To design and analyze single-stage amplifiersand their performance with feedback and cascode configurations.
3. To analyze the designand performance of differential amplifiers in analog circuits.
4. To examine the characteristics and compensation techniquesof operational amplifiers.
5. To understand the design principles of bandgap reference circuits.

Course Outcomes:
At the end of this course, the students will be able to

1. Understand the MOSFET characteristics, biasing techniques and current mirrors for analog circuit design.
2. Design and analyze single-stage amplifiersand their performance with feedback and cascode configurations.
3. Analyze the designand performance of differential amplifiers in analog circuits.
4. Learn the characteristics and compensation techniquesof operational amplifiers.
5. Understand the design principles of bandgap reference circuits.

UNIT-I

Review of MOSFET device characteristics: Second order effects, MOSsmallsignalModel, Capacitances, body bias effect, Current biasing, voltage biasing, Technology biasing, Relative comparison and limitations.

Basic building blocks and basic cells-Switches, active resistors, Current sources and sinks, Current mirrors: Basic current mirror, cascode current mirror, low voltage current mirror, Wilson and Widlar current mirrors, voltage and current references, Mismatch in accuracies, Design solutions to minimize mismatch in accuracies.

UNIT-II

Singlestageamplifier: Analyticaljustificationofoperatingregionsuitableforamplification/switching ,Design of CS amplifier with different loads, Limitations of diode connected load, Improving output impedance of CS amplifier through feedback ,small signal analyses of common gate and common drain topologies and their frequencyresponsewithparasiticaffects,significanceofcascode,design ofcascodeamplifierandwithideal current source load and practical cascode load, Limitations of cascode, folded cascode amplifier and design with parasitics.

UNIT-III

Differential amplifier: Significance of differential signaling, Limitations of quasi differential amplifier, Design of differential amplifier with current source load and diode connected load and small signal analyses, errors due to mismatch, replication principle, qualitative analysis, common mode response, gilbert cell, Common centroid layout.

UNIT-IV

Operationa lamplifier: characterization, two stage O Pamp, small signal analysis, Miller compensation, effect of RHP zero on stability, Lead compensation, constant gmbiasing, design of biasing circuit independent of process and temperature variations.

UNIT-V

Band Gap Reference: General considerations, Supply independent biasing, temperature-independent references, negative-TC voltage, positive TC voltage, Bandgap reference, PTAT generation, curvature correction, Design of BGR under low voltage conditions.

TEXT BOOKS:

1. BehzadRazavi,DesignofAnalogCMOSIntegratedCircuit,McGrawHillEducation,2017,2nd Edition.
2. Paul J. Hurst, Paul R. Gray, Robert G Meyer and Stephen H. Lewis, Analysis and Design of Analog Integrated Circuits, Wiley, 2024, 6thEdition.
3. MohammedIsmailandTerriFiez,AnalogVLSI:SignalandInformationProcessing,McGrawHill, 1994.

REFERENCE BOOKS:

1. RandallL.Geiger,PhillipE.AllenandNoelR.Strader,VLSIDesignTechniquesforAnalogandDigital Circuits, Tata McGraw-Hill Education, 1989.
2. DavidJohns,TonyChanCarusoneandKennethMartin,AnalogIntegratedCircuit Design,Wiley, 2011, 2ndEdition.
3. Paul G. A. Jespers and Boris Murmann, Systematic Design of Analog CMOS Circuits,CambridgeUniversity Press, 2017.

23A04H02	**DIGITAL IC DESIGN** **Honors with VLSI specialization**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand MOSFET and CMOS inverter operation along with constraints.
2. To explore CMOS design techniques for combinational and sequential logic circuits.
3. To gain knowledge on the timing issues in digital circuits.
4. To design and analyze various arithmetic building blocks.
5. To learn about the design and functionality of semiconductor memories.

Course Outcomes:
At the end of this course, the students will be able to

1. To understand MOSFET and CMOS inverter operation along with constraints.
2. To explore CMOS design techniques for combinational and sequential logic circuits.
3. To gain knowledge on the timing issues in digital circuits.
4. To design and analyze various arithmetic building blocks.
5. To learn about the design and functionality of semiconductor memories.

UNIT-I

MOS Inverters: Structure and Operation of MOS Transistor (MOSFET), MOSFET Current-Voltage Characteristics, MOSFET Scaling and Small-Geometry Effect, MOSFET Capacitances, CMOS Inverter- Static and switching characteristics, Delay-Time Definitions, Calculation of Delay Times, Inverter Design with Delay Constraints, Estimation of Interconnect Parasitic, Power Consumption in CMOS Gates.

UNIT-II

Designing Combinational & Sequential Logic Gates in CMOS: Static CMOS design- ratioed logic, pass transistor logic, transmission gate logic, Dynamic CMOS Design, Static Latches and Registers, Dynamic Latches and Registers, Alternative Register Styles, Nonbistable Sequential Circuits, Logic Style for Pipelined Structures.

UNIT-III

Timing Issues in Digital Circuits: Introduction, Synchronous Timing basics, Clock Skew and Jitter, Clock distribution techniques, Clock Generation and Synchronization.

UNIT-IV

DesigningArithmeticBuildingBlocks: Introduction,TheAdder:CircuitandLogicDesign,Multipliers:Shifters, Power Considerations in Datapath Structures.

UNIT-V

Designing Memory: Introduction, Semiconductor Memories - An Introduction, The Memory Core: RAM, ROM, Memory Peripheral Circuitry.

TEXT BOOKS:

1. JanM.Rabaey,AnanthaChandrakasanandBorivojeNikolic,DigitalIntegratedCircuits: ADesign Perspective, Pearson, 2003, 2nd Edition.
2. JohnP.Uyemura,CMOSLogicCircuitDesign,Springer,2001.
3. JohnP.Uyemura,IntroductiontoVLSICircuitsandSystems,Wiley,2002.

REFERENCE BOOKS:

1. Sung-MoKangandYusufLeblebici,CMOSDigitalIntegratedCircuits,McGraw-Hill, 2003,3rdEdition.
2. CharlesHawkins,JaumeSeguraandPaymanZarkesh-Ha,CMOSIntegratedDigitalElectronics:AFirst Course, IET, 2012

23A04H03	**LOW POWER VLSI** **Honors with VLSI specialization**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To explore low-power CMOS VLSI design techniques for minimizing power dissipation.
2. To understand CMOS adder architecturesand low-power design techniques.
3. To analyze various multiplier architectures and low-power design techniques for memories.
4. To examine architectural techniques for minimizing power dissipation in digital systems.
5. To apply low-power design techniques for optimizing power consumption in digital circuits.

Course Outcomes:
At the end of this course, the students will be able to

1. Explore low-power CMOS VLSI design techniques for minimizing power dissipation.
2. Understand CMOS adder architecturesand low-power design techniques.
3. Analyze various multiplier architectures and low-power design techniques for memories.
4. Examine architectural techniques for minimizing power dissipation in digital systems.
5. Apply low-power design techniques for optimizing power consumption in digital circuits.

UNIT 1

Low Power CMOS VLSI design: Introduction: Sources of Power Dissipation, Static Power Dissipation, Active Power Dissipation.

Circuit Techniques for Low Power Design:Design for Low Power, Multiple Vth techniques, Dynamic Vth techniques.

UNIT II

Adders: StandardAdderCells,ReviewofCMOSAddersArchitecturesandperformanceComparison, LowVoltage Low Power Design Techniques, Current Mode Adders.

UNIT III

Multipliers and Memories: Review of Multiplier Architectures, Braun, Booth and Wallace Tree Multipliers and their performance comparison.SourcesofpowerdissipationinSRAMs,LowpowerSRAMcircuittechniques,Sourcesofpowerdissipation in DRAMs, Low power DRAM circuit techniques.

UNIT IV

Architectural Techniques for Low Power: Parameters effecting power dissipation, Variable frequency, Dynamic voltage Scaling, Dynamic Voltage and Frequency Scaling, Reduced VDD, Architectural clock gating, Power gating, Multi-voltage, Optimizing memory power.

UNIT V

Low Power Implementation Techniques: Library Selection, Clock Gating, Timing Impact due to Clock gating, Gate-level power optimization techniques, Power Optimization for Sleep Mode.

Textbooks:

1. KiatSengYeoandKaushik Roy,Low-Voltage,Low-PowerVLSISubsystems, TataMcGrawHill, 2009.
2. SoudrisD,PiguetCandGoutisC,DesigningCMOSCircuitsforLowPower,KluwerAcademic Publishers, 2002.

References:

1. AbdellatifBellaouar,MohamedElmasry,Low-PowerDigitalVLSIDesign:CircuitsandSystems, Springer, 2012.
2. JanRabaey,LowPowerDesignEssentials,Springer,2009.

23A04H04	**TESTING AND VERIFICATION** **Honors with VLSI specialization**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To analyze VLSI testing concepts, fault modeling, and defect analysis for ensuring chip reliability.
2. To explore fault simulation techniques and algorithms for efficient fault detection in digital circuits.
3. To examine test generation techniques for combinational and sequential circuits, fault modeling, and scan chain-based testing.
4. To study and apply test generation algorithms for digital circuits and understand design-for-testability techniques.
5. To apply Design for Testability (DFT) techniques, including BIST architectures and test algorithms for embedded memory.

Course Outcomes:
At the end of this course, the students will be able to

1. Identify faults, model defects, and analyze testing methods for improving VLSI chip quality and yield.
2. Utilize serial, parallel, and deductive fault simulation algorithms for testing and diagnosing faults in digital systems.
3. Implement ATPG and path sensitization methods for fault detection in combinational and sequential circuits and implement scan chain-based testing.
4. Apply D, FAN, and PODEM algorithms for fault detection and implement design-for-testability techniques in digital circuits.
5. Adopt DFT methodologies to enhance testability, generate test patterns, and implement BIST for efficient fault detection in digital systems.

UNIT 1

RoleoftestinginVLSIDesignflow,Testingatdifferentlevelsofabstraction,Fault,error,defect,diagnosis, yield, Types of testing, Rule of Ten, Defects in VLSI chip. Modelling basic concepts, Functional modelling at logic level and register level, structure models, logic simulation, delay models. Various types of faults, Fault equivalence and Fault dominance in combinational sequential circuits.

UNIT II

Fault simulation applications, General fault simulation algorithms- Serial, and parallel, Deductive fault simulation algorithms.

UNIT III

Combinational circuit test generation, Structural Vs Functional test, ATPG, Path sensitization methods. Difference between combinational and sequential circuit testing, five and eight valued algebra, and Scan chain-based testing method.

UNIT IV

D-algorithm procedure, Problems, PODEM Algorithm. Problems on PODEM Algorithm. FAN Algorithm. Problems on FAN algorithm, Comparison of D, FAN and PODEM Algorithms. Design for Testability, Ad- hoc design, Generic scan-based design.

UNIT V

Classical scan-based design, System level DFT approaches Test pattern generation for BIST, Circular BIST.BISTArchitectures.Testablememorydesign-Testalgorithms-TestgenerationforEmbeddedRAMs.

Textbooks:

1. M. Abramovici, M. Breuer, and A. Friedman, "Digital Systems Testing and Testable Design, IEEE Press, 1990.
2. M. Bushnell and V. Agrawal, "Essentials of Electronic Testing forDigital, Memory & Mixed-Signal VLSICircuits", Kluwer Academic Publishers, 2000

References:

1. Stroud,"ADesigner'sGuidetoBuilt-inSelf-Test",KluwerAcademicPublishers,2002
2. V.AgrawalandS.C.Seth,TestGenerationforVLSIChips,ComputerSocietyPress.1989

23A04H05	**FPGA ARCHITECTURES** **Honors with VLSI specialization**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To explore the evolution, design flow, and applications of FPGAs in modern digital systems.
2. To design and implement digital systems using Programmable Logic Devices (PLDs) for complex operations.
3. To study FPGA/CPLD architectures, programming technologies, and commercially available FPGA families.
4. To analyze the architecture, functionality, and performance impact of FPGAs and CPLDs.
5. To understand FPGA routing architectures, routing strategies, and their implementation in modern FPGA families like Kintex-7, Virtex-7, and Artix-7.

Course Outcomes:
At the end of this course, the students will be able to

1. Explain FPGA architecture, design process, and real-world applications in digital circuit implementation.
2. Develop efficient digital circuits such as universal blocks, memory units, floating-point multipliers, and barrel shifters using PLDs.
3. Analyze FPGA/CPLD programming technologies and compare commercially available FPGA architectures like Xilinx, Actel, and Altera.
4. Evaluate FPGA/CPLD building blocks, routing structures, and delay models for efficient digital design.
5. Understand FPGA routing structures, analyze routing strategies, and apply them in real-world FPGA applications using Kintex-7, Virtex-7, and Artix-7.

UNIT 1

IntroductiontoFPGAs: EvolutionofprogrammabledevicesFPGADesignflowApplicationsofFPGA.

UNIT II

DesignExamplesusingPLDs: DesignofUniversalblockMemoryFloatingpointmultiplierBarrelshifter.

UNIT III

FPGAs/CPLDs: ProgrammingTechnologiesCommerciallyavailableFPGAsXilinx’sVertexandSpartan, Actel’s FPGA, Altera’s FPGA/CPLD.

UNIT IV

Building blocks of FPGAs/CPLDs: Configurable Logic block functionality, Routing structures, Input/output Block, Impact of logic block functionality on FPGA performance, Model for measuring delay.

UNIT V

Routing Architectures: Routing terminology, general strategy for routing in FPGAs, routing for row – based FPGAs, introduction to segmented channel routing, routing for symmetrical FPGAs, example of routing in a symmetrical FPGA, general approach to routing in symmetrical FPGAs, independence from FPGA routing architectures, FPGA routing structures. FPGA architectural assumptions, the logic block, the connection block, connection block topology, the switch block, switch block topology, architectural assumptions for the FPGA

CASESTUDY–ApplicationsusingKintex-7,Viretex-7,Artix-7.

Textbooks:

1. John V. Oldfield and Richard C. Dorf, Field Programmable Gate Arrays: Reconfigurable Logic for Rapid Prototyping and Implementation of Digital Systems, Wiley-Interscience, 1995, 1st Edition.
2. FrankBruno,FPGAProgrammingforBeginners,Packt,2021.
3. FrankBrunoandGuyEschemann,TheFPGAProgrammingHandbook, Packt,2024,2nd Edition.
4. StephenD.Brown,RobertJ.Francis,JonathanRoseandZvonkoG.Vranesic,FieldProgrammable Gate Arrays, Springer Science+Business Media, LLC, 1992, 1st Edition.

References:

1. CliveMaxfield,TheDesignWarrior'sGuidetoFPGAs:Devices,ToolsandFlows,Elsevier-Newnes, 2004.
2. DatasheetsofArtix-7,Kintex-7,Virtex-7.

23A04H06	**ANALOG AND DIGITAL IC DESIGN LAB** **Honors with VLSI specialization**	**L**	**T**	**P**	**C**
		0	0	3	1.5

Course Objectives:

1. To gain proficiency in designing and analyzing MOSFET-based analog circuits, including amplifiers and current mirrors.
2. To explore the implementation of feedback topologies and differential amplifiers to enhance circuit performance.
3. To enhance proficiency in simulating and optimizing two-stage operational amplifiers from schematic to post-layout.
4. To acquire proficiency in designing and simulating CMOS inverters and logic gatesusingEDA tools.
5. To explore variousarchitectures for arithmetic circuitssuch as adders, shift registers, and multipliers.
6. To gain hands-on experience infunctional simulation, timing analysis, and RTL-to-GDS-II implementation**.**

Course Outcomes:

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

1. Construct and evaluate single-stage and multi-stage amplifiers with various loads and feedback techniques.
2. Apply the principles of current sources, sinks, and mirrors for effective circuit biasing.
3. Implement and refine CMOS differential and two-stage operational amplifiers through post-layout simulations.
4. Construct and analyze CMOS inverters and logic gates with different design constraints and logic styles.
5. Implement and compare parallel adders, shift registers, and multipliers for performance optimization.
6. Develop and verify digital systems through functional simulation, static timing analysis, and post-synthesis verification.

List of Experiments :

Any five experiments from each group (All circuit still post layout)

Analog IC Design Lab

1. Lambda calculation for PMOS & NMOS, Transconductance plots,
2. Single transistor amplifier with different loads,
3. CS amplifier with source degeneration,
4. Cascode amplifier.
5. Basiccurrentsink,Cascodecurrentsink.
6. Basiccurrentsource,Cascodecurrentsource.
7. Basiccurrentmirror,Wilsoncurrent mirror,
8. Cascodecurrentmirror,

9. Feedback topologies,
10. CMOS differential amplifier with current mirror load.
11. Two stage Operational amplifier.

Digital IC Design Lab

1. DesignandSimulationofCMOSInvertertostudythetransferCharacteristicsbyvaryingthe design constraints using EDA Tools
2. DesignandSimulationoflogicgatesusingvariouslogicstylesandcomparetheperformance

Designthefollowingbuildingblocksemployingvariousarchitecturesanddevelop HDLmodels:

3. 32-bitParalleladderusing8-bitaddermodule,
4. 32-bitShiftregisterusing8-bitShiftregistermodule
5. Combinational and sequential multipliers: 8 x 8 multiplier,
6. Combinational and sequential multipliers: 16 X 16 multipliers
7. Performthefunctionalsimulation,StaticTimingAnalysisandpostsynthesistimin gverification RTL to GDS-II: Design any System as a case Study

Text Books:

1. Behzad Razavi, Design of Analog CMOS Integrated Circuit, McGraw Hill Education, 2017, 2ndEdition.
2. PaulJ.Hurst,PaulR.Gray,RobertGMeyerandStephenH.Lewis,AnalysisandDesignofAnalog Integrated Circuits, Wiley, 2024, 6th Edition.
3. SamirPalnitkar,VerilogHDL,PearsonEducation,2003,2nd Edition.
4. ErikBrunv and, Digital VLSI Chip Design with Cadence and Synopsys CAD Tools, Pearson, 2011.

Reference Books:

1. Randall L. Geiger, Phillip E. Allen and Noel R. Strader, VLSI Design Techniques for Analog and Digital Circuits, Tata McGraw-Hill Education, 1989.
2. David Johns, Tony Chan Carusone and Kenneth Martin, Analog Integrated Circuit Design, Wiley, 2011, 2nd Edition.
3. JosephCavanagh,VerilogHDLDesignExamples,CRCPress,2018.
4. Blaine Readler, Verilog by Example: A Concise Introduction for FPGA Design, Full ARC Press,2011.

23A04H07	**PHYSICAL DESIGN AUTOMATION LAB** **Honors with VLSI specialization**	**L**	**T**	**P**	**C**
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Course Objectives:

1. To implement and analyze graph algorithms used in physical design automation for VLSI.
2. To study and apply line sweep algorithms for solving computational geometry problems efficiently.
3. To explore partitioning algorithms for efficient circuit design, including group migration, simulated annealing, and metric allocation methods.
4. To analyze various floor planning algorithms for VLSI design, focusing on constraint-based, hierarchical, and optimization techniques.
5. To study and apply routing algorithms for efficient pathfinding in VLSI design and network communication.

Course Outcomes:

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

1. Apply graph-based algorithms to solve problems like spanning trees, shortest paths, and Steiner trees in VLSI design.
2. Implement and analyze line sweep and extended line sweep methods for geometric problem-solving.
3. Apply partitioning techniques to optimize circuit design using algorithms like Kernighan-Lin, simulated annealing, and metric allocation.
4. Utilize floor planning algorithms to optimize area, performance, and layout efficiency in VLSI design.
5. Implement and analyze two-terminal and multi-terminal routing algorithms for optimal interconnection in circuits and networks.

List of Experiments: Any ten experiments are to be conducted (Minimum one from each group)

I. Graphalgorithms
   1. Graph search algorithms
      - Depth first search
      - Breadth first search
   2. Spanning tree algorithm
      - Kruskal’s algorithm
   3. Shortest path algorithm
      - Dijkstra algorithm
      - Floyd-Warshall algorithm
   4. Steiner tree algorithm

II. Computational geometry algorithm

1. Line sweep method
2. Extended line sweep method

III. Partitioning algorithms

1. Group migration algorithms
    - Kernighan –Lin algorithm
    - Extensions of Kernighan-Lin algorithm
        - Fiduccias –Mattheyses algorithm
        - Goldberg and Burstein algorithm
2. Simulated annealing and evolution algorithms
    - Simulated annealing algorithm
    - Simulated evolution algorithm
3. Metric allocation method

IV. Floor planning algorithms

1. Constraint based methods
2. Integer programming based methods
3. Rectangular dualization based methods
4. Hierarchical tree based methods
5. Simulated evolution algorithms
6. Time driven Floorplanning algorithms

V. Routing algorithms

1. Two terminal algorithms
    - Maze routing algorithms
        - Lee’s algorithm
        - Soukup’s algorithm
        - Hadlock algorithm
    - Line-Probe algorithm
    - Shortest path based algorithm
2. Multi terminal algorithm
    - Stenier tree based algorithm
        - SMST algorithm
        - Z-RST algorithm