VEMU INSTITUTE OF TECHNOLOGY

(UGC-Autonomous)

Affiliated to

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, ANANTAPUR

B.Tech-ECE COURSE STRUCTURE
(R23) Regulations

Applicable for B.Tech (Regular-Full time)

(Effective for the students admitted into II, III &IV year from the Academic Year **2024-2025** onwards)

And

B.Tech (Lateral Entry Scheme)

II B.Tech I Semester (E.C.E)

S.No.	Course code	Title	L	T	P	Credits
1	23BTHS09T	Probability and Complex Variables	3	0	0	3
2	23BTBA01T	Universal Human Values– Understanding Harmony and Ethical Human Conduct	2	0	0	2
3	23BTEC01T	Signals, Systems and Stochastic Processes	3	0	0	3
4	23BTEC02T	Electronic Devices and Circuits	3	0	0	3
5	23BTEC03T	Digital Circuits Design	3	0	0	3
6	23BTEC01P	Electronic Devices and Circuits Lab	0	0	3	1.5
7	23BTEC02P	Digital Circuits & Signal Simulation Lab	0	0	3	1.5
8	23BTCS01S	Python Programming	0	1	2	2
9	23BTCE01A	Environmental Science	2	0	0	0
Total			16	01	08	19

II B.Tech II Semester (E.C.E)

S.No.	Course code	Title	L	T	P	Credits
1	23BTBA02T 23BTBA03T 23BTBA04T	Managerial Economics & FinancialAnalysis Organizational Behaviour Business Environment (Common to EEE,ECE,CSE)	2	0	0	2
2	23BTEE08T	Linear Control Systems	3	0	0	3
3	23BTEC04T	EM Waves and Transmission Lines	3	0	0	3
4	23BTEC05T	Electronic Circuits Analysis	3	0	0	3
5	23BTEC06T	Analog and Digital Communications	3	0	0	3
6	23BTEC03P	Electronic Circuits Analysis Lab	0	0	3	1.5
7	23BTEC04P	Analog and Digital Communications Lab	0	0	3	1.5
8	23BTHS14T	Soft Skills (Skill Oriented Course) (Common to CE,ME,ECE,CHEM)	0	1	2	2
9	23BTME09T	Design Thinking & Innovation (Common to All Branches)	1	0	2	2
Total			15	2	10	22
23A49903-MandatoryCommunityServiceProjectInternshipof08weeks'durationduring summer vacation						

III B.Tech I Sem (E.C.E)

S.No	Course code	Title	L	T	P	Credits
1	23BTEC09T	Analog and Digital IC Applications	3	0	0	3
2	23BTEC10T	Antennas &Wave Propagation	3	0	0	3
3	23BTEC11T	Microprocessors and Microcontrollers	3	0	0	3
4		Introduction To QuantumTechnologies and Applications	3	0	0	3
5	23BTEC12a 23BTEC12bT 23BTEC12cT	**Professional Elective-I** 1. Computer Architecture & Organization 2. Information theory and coding 3. Detection and EstimationTheory	3	0	0	3
6	23BTEC13T	**OpenElective-I**	3	0	0	3
7	23BTEC06P	Analog & Digital IC Applications Lab	0	0	3	1.5
8	23BTEC07P	Microprocessors and Microcontrollers Lab	0	0	3	1.5
9	23BTEC08P	**Skill Enhancement course** PCB Design and Prototype development.	0	1	2	2
10	23BTEC09P	Tinkering Lab	0	0	2	1
11	23BTECCS	Evaluation of Community Service Internship	-	-	-	2
Total			**18**	**1**	**10**	**26**

OpenElective–I

S.No.	Course Code	Course Name	Offered by the Dept.
1		Green Buildings	CIVIL
2		Construction Technology and Management	
3		Electrical Safety Practices and Standards	EEE
4		Sustainable Energy Technologies	ME
5	23BTEC13T	Java Programming	CSE&Allied/IT
6		Fundamentals of ArtificialI ntelligence	
7		QuantumTechnologies and Applications	
8		Mathematics for Machine Learning and AI	Mathematics
9		Materials Characterization Techniques	Physics
10		Chemistry of Energy Systems	Chemistry
11		English for Competitive Examinations	Humanities
12		Entrepreneurship and New Venture Creation	

Note:

1. Astudent is permitted to register for Honoursor aMinor inIV semester after the results ofIII Semester are declared, and students may be allowed to take a maximum of 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 Sem (E.C.E)

S. No.	Course code	Title	L	T	P	Credits
1	23BTEC15T	Digital Signal Processing	3	0	0	3
2	23BTEC16T	Microwave and Optical Communications	3	0	0	3
3	23BTEC17T	VLSI Design	3	0	0	3
4	23BTEC18aT 23BTEC18bT 23BTEC18cT	**Professional Elective-II** 1. Electronic Measurements and Instrumentation 2. Embedded systems & IOT 3. Speech Processing	3	0	0	3
5	23BTEC19aT 23BTEC19bT 23BTEC19cT	**Professional Elective-III** 1. Digital Image Processing 2. Artificial Intelligence & Machine learning 3. Satellite Communications	3	0	0	3
6	23BTEC20T	**Open Elective-II**	3	0	0	3
7	23BTEC11P	Microwave and Optical Communications Lab	0	0	3	1.5
8	23BTEC12P	VLSI Design Lab	0	0	3	1.5
9	23BTEC13P	**Skill Enhancement course** Machine Learning and DSP	0	1	2	2
10	23BTEC21T	Technical Paper Writing & IPR	2	0	0	-
Total			**20**	**1**	**08**	**23**
Mandatory Industry Internship of 08weeks duration during summer vacation						

OpenElective–II

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

IV B.Tech I Sem (E.C.E)

S.No.	Category	Title	L	T	P	Credits
1	23BTEC22T	Data Communications and Networking	3	0	0	3
2		**ManagementCourse-II** 1. Business Ethics and Corporate Governance 2. E-Business 3. Management Science	2	0	0	2
3	23BTEC23aT 23BTEC23bT 23BTEC23cT	**Professional Elective-IV** 1. Radar Engineering 2. DSP Processors & Architectures 3. Cellular &Mobile Communications	3	0	0	3
4	23BTEC24aT 23BTEC24bT 23BTEC24cT	**Professional Elective-V** 1. Low Power VLSI Design 2. Wireless Sensor Networks 3. 5G Communications	3	0	0	3
5	23BTEC11T	**Open Elective-III**	3	0	0	3
6	23BTEC25T	**Open Elective-IV**	3	0	0	3
7	23BTEC14P 23BTEC15P	**Skill Enhancement course** 1. RF System Design tools 2. Industrial IOT& Automation	0	1	2	2
8	23BTEC27T	**Audit Course** Gender Sensitization	2	0	0	-
9	23BTECII	Evaluation of Industry Internship	-	-	-	2
Total			**19**	**1**	**02**	**21**

OpenElective–III

S.No	CourseCode	CourseName	Offeredbythe Dept.
1		Building Materials and Services	CIVIL
2		Environmental Impact Assessment	
3		Smart Grid Technologies	EEE
4		3DPrinting Technologies	ME
5		Data Base Management Systems	CSE&Allied/IT
6		Cyber Security	
7		Wavelet Transforms and its Applications	Mathematics
8		Smart Materials And Devices	Physics
9		Introduction to Quantum Mechanics	
10		Green Chemistry And Catalysis For Sustainable Environment	Chemistry
11		Employability Skills	Humanities

OpenElective–IV

S.No	CourseCode	CourseName	Offeredbythe Dept.
1		Geo-Spatial Technologies	CIVIL
2		SolidWaste Management	
3		Electric Vehicles	ME
4		Total Quality Management	EEE
5		Introduction to Computer Networks	CSE&Allied/IT
6		Internet of Things	
7		Introduction to Quantum Computing	
8		Financial Mathematics	Mathematics
9		Sensors And Actuators For Engineering Applications	Physics
10		Chemistry of Nano materials And Applications	Chemistry
11		Literary Vibes	Humanities

IV B.Tech II Sem E.C.E)

S.No.	Coursecode	Title	Category	L	T	P	Credits
1	23BTECD	Internship		-	-		4
		Project					8
Total							**12**

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

S.No.	CourseCode	Title	L	T	P	Credits
1		Analog IC Design.	3	0	0	3
2		Digital IC Design	3	0	0	3
3		Low power VLSI	3	0	0	3
4		Testing and Verification	3	0	0	3
5		FPGA architectures	3	0	0	3
6		Analog and Digital IC Design Lab	0	0	3	1.5
7		Physical Design Automation Lab	0	0	3	1.5
Total			**15**	**0**	**06**	**18**

LISTOFMINORSOFFEREDTOELECTRONICS &COMMUNICATIONENGINEERING

S.No.	MinorTitle	DepartmentofferingtheMinor
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	CyberSecurity	
8	Internet of Things	
9	Data Science	
10	Artificial Intelligence & Machine Learning	
11	Data Analytics	
12	Data Science	
13	Programming & Computational Intelligence	
14	AI Applications & Emerging Technologies	
15	Quantum Computing	
16	Quantum Technologies	

II B.Tech I Sem (E.C.E)

23BTHS09T	**Probability And Complex Variables**	L	T	P	C
		3	**0**	**0**	**3**

COURSE OBJECTIVE :

This course aims at providing the student to acquire knowledge of the basic probability concepts and acquire skills in handling situations involving more than one random variable, functions of random variables and calculus of functions of complex variables.

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

- Apply the concepts of Probability, Random Variables and their characteristics.
- Learn how to deal with multiple random variables, conditional probability, joint distribution and statistical independence.
- Formulate and solve engineering problems involving random variables.
- Analyze limit, continuity and differentiation of functions of complex variables and apply Cauchy-Riemann equations, analytic functions and various properties of analytic functions.
- Apply Cauchy Theorem and Cauchy integral formulas to evaluate complex contour integrals. Classify singularities and poles; find residues and evaluate complex integrals using the residue theorem.

UNIT I :

Probability & Random Variable

Probability through Sets and Relative Frequency: Experiments and Sample Spaces, Discrete and Continuous Sample Spaces, Events, Probability Definitions and Axioms, Joint Probability, Conditional Probability, Total Probability, Bayes Theorem, Independent Events. Random variables (discrete and continuous), probability density functions, properties, mathematical expectation. Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh.

UNIT II :

Operations on Random variable

Moments-moments about the origin, Central moments, Variance and Skew, Chebyshev's inequality, moment generating function, characteristic function. Multiple Random Variables: Vector Random Variables, Joint Distribution Function, Properties of Joint Distribution, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Interval conditioning, Statistical Independence.

UNIT III :

Operations on Multiple Random variables

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Moments about the Origin, Joint Central Moments, Joint Characteristic Functions, Jointly Gaussian Random Variables: Two Random Variables case, N Random Variable case, Properties of Gaussian random variables.

UNIT IV :

Complex Variable–Differentiation

Introduction to functions of complex variable-concept of Limit & continuity- Differentiation, Cauchy-Riemann equations, analytic functions, properties of analytic functions, harmonic functions, finding harmonic conjugate-construction of analytic function by Milne Thomson method.

UNIT V :

Complex Variable–Integration

Line integral-Contour integration, Cauchy's integral theorem (Simple Case), Cauchy Integral formula, Power series expansions: Taylor's series, zeros of analytic functions, singularities, Laurent's series, Residues, Cauchy Residue theorem (without proof),Evaluation of definite integral involving sine and cosine.

Textbooks:

1. Peyton Z. Peebles, **—Probability, Random Variables & Random Signal Principles‖**, 4th Edition, TMH, 2002.
2. B.S.Grewal, **Higher Engineering Mathematics**,KhannaPublishers,2017,44thEdition

Reference Books:

1. Athanasios Papoulis and S.Unnikrishna Pillai, **—Probability, Random Variables and Stochastic Processes‖**, 4th Edition, PHI, 2002
2. Erwin Kreyszig, **Advanced Engineering Mathematics**, Wiley India
3. Henry Stark and John W. Woods, **—Probability and Random Processes with Application to Signal Processing,‖** 3rd Edition, Pearson Education, 2002.
4. B.V.Ramana, **Higher Engineering Mathematics**, McGraw Hill publishers.

II B.Tech I Sem (E.C.E)

23BTBA01T	**UNIVERSAL HUMAN VALUES** **Understanding Harmony and Ethical Human Conduct** (Common to All Branches of Engineering)	**L**	**T**	**P**	**C**
		2	0	0	2

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human being.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence.
- Forming basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes (CO): Student will be able to

CO 1 – Understand the concepts of value education and human aspirations. CO 2 – Understand the harmony in the human beings
CO 3 – Understand the harmony in the family and society CO4 – Understand the harmony in the nature
CO 5 – Apply the ethics towards value-based life and profession

UNIT – I: Introduction to Value Education Lecture Hrs: 06

Introduction to Value Education (6 lectures and 3 tutorials for practice session)
Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)
Lecture 2: Understanding Value Education
Tutorial 1: Practice Session PS1 Sharing about Oneself Lecture 3: self-exploration as the Process for Value Education
Lecture4: Continuous Happiness and Prosperity – the Basic Human Aspirations Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario Lecture 6: Method to Fulfill the Basic Human Aspirations Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT – II: Harmony in the Human Being Lecture Hrs: 06

Harmony in the Human Being (6 lectures and 3 tutorials for practice session) Lecture 7: Understanding Human being as the Co-existence of the self and the body. Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body. Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT – III: Harmony in the Family and Society Lecture Hrs: 06

Harmony in the Family and Society (6 lectures and 3 tutorials for practice session) Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: 'Trust' – the Foundational Value in Relationship Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society Lecture 18: Vision for the Universal Human Order Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal	
UNIT – IV: Harmony in the Nature/Existence	Lecture Hrs: 06
Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session) Lecture 19: Understanding Harmony in the Nature Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature	

Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

UNIT – V: Implications of the Holistic Understanding | Lecture Hrs: 06

Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order Lecture 26: Competence in Professional Ethics
Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education PS1 Sharing about Oneself
PS2 Exploring Human Consciousness PS3 Exploring Natural Acceptance
Practice Sessions for UNIT II – Harmony in the Human Being PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self PS6 Exploring Harmony of self with the body
Practice Sessions for UNIT III – Harmony in the Family and Society PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal
Practice Sessions for UNIT IV – Harmony in the Nature (Existence) PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence
Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

Textbooks:

- R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
- Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal

10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions. While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self exploration. Scenarios may be used to initiate discussion. The student is encouraged to take up ‖ordinary‖ situations rather than‖ extra-ordinary‖ situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics,
worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide

support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values. It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses.

This course is to be taught by faculty from every teaching department, not exclusively by any one department. Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Learning Resources:

- https://fdpsi.aicteindia.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%201- Introduction%20to%20Value%20Education.pdf
- https://fdpsi.aicteindia.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%20-Harmony%20in%20the%20Human%20Being.pdf
- https://fdpsi.aicteindia.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handout%203- Harmony%20in%20the%20Family.pdf
- https://fdpsi.aicteindia.org/UHV%201%20Teaching%20Material/D3S2%20Respect%20July%2023.pdf
- https://fdpsi.aicteindia.org/UHVII%20Class%20Notes%20&%20Handouts/UHV%20Handou%205- Harmony%20in%20the%20Nature%20and%20Existence.pdf
- https://fdpsi.aicteindia.org/download/FDPTeachingMaterial/3days%20FDPSI%20UHV%20Teching%20Material/Day203%20Handouts/UHV%203D%20D3S2A%20Und%20NatureExistence.pdf
- https://fdpsi.aicteindia.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%202325%20Ethics%20v1.pdf
- https://www.studocu.com/in/document/kietgroupofinstitutions/universalhumanvalues/chapter5-holistic- understanding-of-harmony-on-professional-ethics/62490385
- https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

II B.Tech I Sem (E.C.E)

23BTEC01T	**SIGNALS, SYSTEMS AND STOCHASTIC PROCESSES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Understand the basics of signals and systems required for ECE courses.
- To Teach concepts of signals and systems and their analysis using different transform techniques.
- To Provide a basic understanding of random processes, essential for random signals and systems encountered in communications and signal processing areas.

Course Outcomes (CO): Student will be able to

- Analyze the mathematical description and representation of continuous-time and discrete-time signals and systems and understand the concepts of various transform techniques and random processes. (L3)
- Apply sampling theorem to convert continuous-time signals to discrete-time signals and reconstruct them and use different transform techniques to solve signals and system-related problems. (L3)
- Formulate and solve engineering problems involving random processes. (L3)
- Analyze the frequency spectra of various continuous-time signals using different transform methods. (L4)
- Classify systems based on their properties and determine their responses. (L4)

UNIT – I: Signals & Systems Lecture Hrs: 12

Basic definitions and classification of signals and systems (continuous time and discrete time), operations on signals, concepts of convolution and correlation of signals, analogy between vectors and signals—orthogonality, mean square error. Fourier series: Trigonometric and exponential forms of Fourier series, properties, concept of discrete spectrum. Illustrative problems.

UNIT – II: Transforms Lecture Hrs: 12

Fourier Transform : Definition, computation, and properties of Fourier transform for different types of signals and systems, inverse Fourier transform. Sampling: Sampling theorem—graphical and analytical proof for band-limited signals, reconstruction of signal from its samples, effect of under-sampling—aliasing. Illustrative problems.

Laplace Transform: Definition, ROC, Properties, Inverse Laplace Transforms, s-plane and BIBO Stability, Transfer Functions, System Response to Standard Signals, Solution of Differential Equations with Initial Conditions, Illustrative Problems.

UNIT – III: Signal Transmission through Linear Systems Lecture Hrs: 12

Linear system, impulse response, response of a linear system for different input signals, linear time-invariant (LTI) system, linear time-variant (LTV) system, transfer function of an LTI system. Filter characteristics of linear systems. Distortionless transmission through a system, signal bandwidth, system bandwidth, ideal low-pass filter (LPF), high-pass filter (HPF), and band-pass filter (BPF) characteristics. Causality and Paley-Wiener criterion for physical realization, relationship between bandwidth and rise time, energy and power spectral densities, illustrative problems.

UNIT – IV: Random Processes –Temporal Characteristics Lecture Hrs: 12

The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, Concept of Stationarity and Statistical Independence. First-Order Stationary Processes, Second Order and Wide-Sense Stationarity, (N-Order) and Strict Sense Stationarity, Time Averages and Ergodicity, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal, Mean and Mean-Squared Value of System Response, Autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

UNIT – V: Random Processes–Spectral Characteristics Lecture Hrs: 12

Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function. Cross-Power Density Spectrum: Properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Spectral Characteristics of System Response:

Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output.
Textbooks:
• Peyton Z. Peebles, *Probability, Random Variables & Random Signal Principles*, 4th Edition, TMH, 2002. • A. V. Oppenheim, A. S. Willsky, and S. H. Nawab, *Signals and Systems*, 2nd Edition, PHI, 2009.
Reference Books: 1. Signals, Systems & Communications-B.P.Lathi,2013, BSP. 2. Athanasios Papoulis and S.Unnikrishna Pillai, ―Probability, Random Variables and Stochastic Processes‖,4thEdition,PHI,2002 3. Simon Haykinand Van Veen, ―Signals &Systems‖,2nd Edition,Wiley,2005. 4. Matthew Sadiku and Warsame H. Ali, ― Signals and Systems A primer with MATLAB‖, CRC Press,2016. 5. Hwei Hsu, ―Schaum's Outline of Signals and Systems‖,4th Edition,TMH,2019.

II B.Tech I Sem (E.C.E)

23BTEC02T	**ELECTRONIC DEVICES & CIRCUITS**	L	T	P	C
		3	0	0	3

Course Objectives: Student will be able to

- Understand basic principles of all semiconductor devices
- Analyze diode circuits, various biasing and small-signal equivalent circuits of amplifiers, and compare performance of BJTs and MOSFETs
- Design rectifier circuits and various amplifier circuits using BJTs and MOSFETs

Course Outcomes (CO): Student will be able to

- Analyze the principle of operation, characteristics, and applications of semiconductor diodes, special diodes, BJTs, JFETs, and MOSFETs.
- Apply the basic principles to solve problems related to semiconductor diodes, BJTs, and MOSFETs.
- Analyze diode circuits for different applications such as rectifiers, clippers, and clampers; also analyze biasing circuits of BJTs and MOSFETs.
- Design diode circuits and amplifiers using BJTs and MOSFETs.
- Compare the performance of various semiconductor devices.

UNIT – I Lecture Hrs: 12

PN Junction Diode: Review, diode current equation, diode resistance, transition and diffusion capacitance, effect of temperature on PN junction diode, quantitative analysis of half-wave, full-wave, and bridge rectifiers with and without filters, ripple factor and regulation characteristics, clipping and clamping circuits, illustrative problems.

Special Diodes: Construction, operation, and V-I characteristics of tunnel diode, varactor diode, LED, LCD, photodiode, SCR, and UJT.

UNIT – II: Lecture Hrs: 12

Review of Bipolar Junction Transistors: Characteristics, transistor as an amplifier and as a switch, BJT configurations, limits of operation, BJT specifications.

Biasing and Stabilization: Operating point, DC and AC load lines, importance of biasing, fixed bias, collector-to-base bias, self-bias, bias stability, thermal runaway, thermal stability, illustrative problems.

UNIT – III Lecture Hrs: 12

BJT Small Signal Operation and Models: The transconductance, input resistance at the base, input resistance at the emitter, voltage gain, separating the signal and the DC quantities, the hybrid π model, the T model.

Single Stage BJT Amplifiers: Common-Emitter (CE) amplifier without and with emitter resistance, Common-Base (CB) amplifier, Common-Collector (CC) amplifier or Emitter Follower, problem solving.

UNIT – IV Lecture Hrs: 12

Junction Field Effect Transistor (FET): Construction, principle of operation, V–I characteristics, comparison of BJT and FET, FET as a voltage variable resistor, FET biasing.

MOS Field Effect Transistors: Introduction, device structure and physical operation, CMOS, V–I characteristics, MOSFET circuits at DC, MOSFET as an amplifier and as a switch. Biasing in MOS amplifier circuits – biasing by fixing \(V_{GS} \) with and without source resistance, biasing using drain-to-gate feedback resistor, biasing using constant current source, body effect, problem solving.

UNIT – V: Random Processes–Spectral Characteristics Lecture Hrs: 12

MOSFET Small Signal Operation Models – DC bias, separating the DC analysis and the signal analysis, small signal equivalent circuit models, the transconductance, the T equivalent circuit model. Single-stage MOS Amplifiers – common source (CS) amplifier without and with source resistance, common gate (CG) amplifier, source follower. Problem solving.

Textbooks:

1. Adel S. Sedra and Kenneth C. Smith,—Micro electronic Circuits – Theory and Applications‖,6th Edition,OxfordPress,2013.
2. J.Milliman and C Halkias,— Integrated electronics‖,2nd Edition,TataMcGraw Hill, 1991.

References:

1. Donald A Neamen,— Electronic Circuits–analysis and design‖,3rdEdition,McGraw Hill(India),2019.
2. Behzad Razavi,—Microelectronics‖,Secondedition,Wiley,2013.
3. R.L.Boylestad and Louis Nashelsky,— Electronic Devices and Circuits,‖9thEdition, Pearson,2006.
4. Jimmie J Cathey,— Electronic Devices and Circuits,‖Schaum's outlines series,3rd edition, McGraw-Hill(India),2010.

II B.Tech I Sem (E.C.E)

23BTEC03T	**DIGITAL CIRCUITSDESIGN**	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the properties of Boolean algebra, logic operations, and minimization of Boolean functions.
- Analyze combinational and sequential logic circuits.
- Understand the concepts of FSM and compare various programmable logic devices.
- Model combinational and sequential circuits using HDLs.

Course Outcomes (CO): Student will be able to

- Explain the properties of Boolean algebra, logic operations, and concepts of FSM (L2).
- Apply techniques for minimization of Boolean functions (L3).
- Analyze combinational and sequential logic circuits (L4).
- Compare various programmable logic devices (L4).
- Design and model combinational and sequential circuits using HDLs (L5, L6).

UNIT – I : Boolean algebra, logic operations and minimization of Boolean functions — Lecture Hrs: 12

Review of number systems and codes, representation of unsigned and signed integers, floating point representation of real numbers, laws of Boolean algebra, theorems of Boolean algebra, realization of functions using logic gates, canonical forms of Boolean functions, minimization of functions using Karnaugh maps.

UNIT – II : Combinational Logic Circuits — Lecture Hrs: 12

Combinational circuits, design with basic logic gates, design procedure, adders, subtractors, 4-bit binary adder/subtractor circuit, BCD adder, carry look-ahead adder, binary multiplier, magnitude comparator, data selectors, priority encoders, decoders, multiplexers, demultiplexers.

UNIT – III : Hardware Description Language — Lecture Hrs: 12

Introduction to Verilog: structural specification of logic circuits, behavioral specification of logic circuits, hierarchical Verilog code, Verilog for combinational circuits—conditional operator, if-else statement, case statement, for loop; using sequential circuits with CAD tools.

UNIT – IV : Sequential Logic Circuits — Lecture Hrs: 12

Basic architectural distinction between combinational and sequential circuits, design procedure, latches, flip-flops, truth tables and excitation tables, timing and triggering considerations, conversion of flip-flops, design of counters, ripple counters, synchronous counters, ring counter, Johnson counter, registers, shift registers, universal shift register. Verilog constructs for sequential circuits, flip-flop with clear capability, using Verilog constructs for registers and counters.

UNIT – V: Finite State Machines and Programmable Logic Devices — Lecture Hrs: 12

Types of FSM, capabilities and limitations of FSM, state assignment, realization of FSM using flip-flops, Mealy to Moore conversion and vice versa, reduction of state tables using partition technique, design of sequence detector. Types of PLDs: PROM, PAL, PLA, basic structure of CPLD and FPGA, advantages of FPGAs.

Textbooks:

1. M. Morris Mano, Digital Design, 3rd Edition, PHI. (Units I to IV)
2. Stephen Brown and Zvonko Vranesic, Fundamentals of Digital Logic with Verilog Design, 3rd Edition, McGraw-Hill. (Unit V)

References:

1. Charles H. Roth, Jr., *Fundamentals of Logic Design*, 4th Edition, Jaico Publishers.
2. Zvi Kohavi and Niraj K. Jha, *Switching and Finite Automata Theory*, 3rd Edition, Cambridge University Press, 2010.
3. Samir Palnitkar, *Verilog HDL: A Guide to Digital Design and Synthesis*, 2nd Edition, Prentice Hall PTR.
4. D. P. Leach, A. P. Malvino, *Digital Principles and Applications*, TMH, 7th Edition.

II B.Tech I Sem (E.C.E)

23BTEC01P	**ELECTRONIC DEVICES & CIRCUITSLAB**	L	T	P	C
		0	0	3	1.5

Course Objectives:

- Verify the theoretical concepts practically from all the experiments.
- Analyze the characteristics of diodes, BJT, MOSFET, and UJT.
- Design amplifier circuits based on given specifications.
- Model electronic circuits using tools such as PSPICE/Multisim.

Course Outcomes (CO): Student will be able to

- Apply the characteristics and applications of basic electronic devices.(L2)
- Plot the characteristics of electronic devices.(L3)
- Analyze various biasing circuits and electronic circuits as amplifiers.(L4)
- Design MOSFET/BJT-based amplifiers for the given specifications.(L5)
- Simulate all circuits in PSPICE/Multisim.(L5)

LIST OF EXPERIMENTS: (Implement/**Execute any 10 experiments**).

1. Verify various clipping and clamping circuits using PN junction diodes and draw the suitable graphs.
2. Study and draw the volt-ampere characteristics of a UJT and determine η, IP, Iv, VP, and Vv from the experiment.
3. Verify the input and output characteristics of a BJT in common emitter configuration experimentally and find the required parameters from the graphs.
4. Study and draw the input and output characteristics of a BJT in common base configuration experimentally and determine the required parameters from the graphs.
5. Verify the input and output characteristics of a BJT in common collector configuration experimentally and find the required parameters from the graphs.
6. Study and draw the V-I characteristics of a JFET experimentally.
7. Study and draw the output and transfer characteristics of a MOSFET (enhancement mode) in common source configuration experimentally. Find the threshold voltage (V_T), g_m, and K from the graphs.
8. Study and draw the output and transfer characteristics of a MOSFET (depletion mode) or JFET in common source configuration experimentally. Find I_{DSS}, g_m, and V_P from the graphs.
9. Design and analyze a voltage-divider bias/self-bias circuit using BJT.
10. Design and analyze a self-bias circuit using MOSFET.
11. Design a suitable circuit for switching using MOSFET/BJT.
12. Design a small signal amplifier using MOSFET (common source) for the given specifications. Draw the frequency response and find the bandwidth.
13. Design a small signal amplifier using BJT (common emitter) for the given specifications. Draw the frequency response and find the bandwidth.

Tools /Equipment Required: Software tools like Multisim, PSPICE, or equivalent; DC power supplies; Multimeters; DC ammeters; DC voltmeters; AC voltmeters; CROs; all required active devices.

II B.Tech I Sem (E.C.E)

23BTEC02P	**DIGITAL DESIGN &SIGNAL SIMULATION LAB**	L	T	P	C
		3	0	0	3

Course Objectives:

- Verify the truth tables of various logic circuits.
- Design sequential and combinational circuits using Hardware Description Language and verify their functionality.
- Simulate various signals and systems using MATLAB.
- Analyze the output of a system when it is excited by different types of deterministic and random signals.

Course Outcomes (CO): Student will be able to

- Apply the truth tables of various logic circuits (L2).
- Understand how to simulate different types of signals and system responses (L2).
- Design sequential and combinational logic circuits and verify their functionality (L3, L4).
- Analyze the response of different systems when they are excited by different signals and plot the power spectral density of signals (L4).
- Generate different random signals for the given specifications (L5).

PART – A Lecture Hrs: 12

1. Design a simple combinational circuit with four variables and obtain the minimal SOP expression. Verify the truth table using a Digital Trainer Kit.
2. Verify the functional table of a 3-to-8 line Decoder/De-multiplexer.
3. Verify a 4-variable logic function using an 8-to-1 multiplexer.
4. Design a full-adder circuit and verify its functional table.
5. Design a four-bit ring counter using D Flip-Flops/JK Flip-Flops and verify the output.
6. Design a four-bit Johnson's counter using D Flip-Flops/JK Flip-Flops and verify the output.
7. Verify the operation of a 4-bit Universal Shift Register for different modes of operation.
8. Draw the circuit diagram of a MOD-8 ripple counter and construct a circuit using T-Flip-Flops. Test it with a low-frequency clock and sketch the output waveforms.
9. Design a MOD-8 synchronous counter using T Flip-Flops. Verify the result and sketch the output waveforms.
10. (a) Draw the circuit diagram of a single-bit comparator and test the output.
    (b)Construct a 7-segment display circuit using a Decoder and 7-segment LED, and test it.

PART B Lecture Hrs: 12

1. Write a program to generate various signals and sequences: Periodic and Aperiodic, Unit Impulse, Unit Step, Square, Sawtooth, Triangular, Sinusoidal, Ramp, Sinc function.
2. Perform operations on signals and sequences: Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3. Write a program to find the trigonometric and exponential Fourier series coefficients of a rectangular periodic signal. Reconstruct the signal by combining the Fourier series coefficients with appropriate weightings. Plot the discrete spectrum of the signal.
4. Write a program to find the Fourier transform of a given signal. Plot its amplitude and phase spectrum.
5. Write a program to convolve two discrete-time sequences. Plot all these sequences.
6. Write a program to find the autocorrelation and cross-correlation of given sequences.
7. Write a program to verify the linearity and time invariance properties of a given continuous system.
8. Write a program to generate a discrete-time sequence by sampling a continuous-time signal. Show that with sampling rates less than the Nyquist rate, aliasing occurs while reconstructing the signal.
9. Write a program to find the magnitude and phase response of first-order low-pass and high-pass filters. Plot the responses on a logarithmic scale.
10. Write a program to generate complex Gaussian noise and find its mean, variance,

Probability Density Function (PDF), and Power Spectral Density (PSD). 11. Generate random data (with bipolar) for a given data rate (e.g., 10 kbps). Plot the data for a time period of 0.2 seconds. 12. To Plot the pole-zero diagram in the S-plane of a given signal/sequence and verify its stability. **Note:** Conduct 10 experiments, all of which should be simulated using MATLAB or equivalent software.
Reference
Stephen J. Chapman, ―MATLAB Programming for Engineers‖, Cengage, November2012.

II B.Tech I Sem (E.C.E)

23BTCS01S	**Python Programming** (Skill Enhancement Course)	L	T	P	C
		0	1	2	2

Course Objectives:

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these.

Course Outcomes (CO): Student will be able to

CO1: Design solutions to mathematical problems

CO2: Develop, run and manipulate python programs using core data structures, files and object oriented programming (OOP) principles.

CO3: Develop various applications using Python libraries and frameworks such as JSON, XML NumPy, and pandas for efficient data manipulation and processing.

UNIT – I Lecture Hrs: 12

History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Readin Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif…else, Nested if statement, whil Loop, for Loop, continue and break Statements, Catching Exceptions Using try and excep Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
   i) Arithmetic Operators ii) Relational Operators iii) Assignment Operator iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators.
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT – II: Lecture Hrs: 12

Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling th function, return Statement and void Function, Scope and Lifetime of Variables, Defaul Parameters, Keyword Arguments, args and kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String b Index Number, String Slicing and Joining, String Methods, Formatting Strings.

Lists: Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Use on Lists, List Methods, del Statement.

Sample Experiments:

7. Write a program to define a function with multiple return values.
8. Write a program to define a function using default arguments.
9. Write a program to find the length of the string without using any library functions.
10. Write a program to check if the substring is present in a given string or not.
11. Write a program to perform the given operations on a list:
    i. Addition ii. Insertion iii. slicing
12. Write a program to perform any 5 built-in functions by taking any list.

UNIT – III Lecture Hrs: 12

Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.
Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicin in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

7. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
8. Write a program to count the number of vowels in a string (No control flow allowed).
9. Write a program to check if a given key exists in a dictionary or not.
10. Write a program to add a new key-value pair to an existing dictionary.
11. Write a program to sum all the items in a given dictionary.

UNIT – IV | Lecture Hrs: 12

Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Object in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Dat Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

18. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
19. Python program to print each line of a file in reverse order.
20. Python program to compute the number of characters, words and lines in a file.
21. Write a program to create, display, append, insert and reverse the order of the items in th array.
22. Write a program to add, transpose and multiply two matrices.
23. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle triangle, and square.

UNIT – V | Lecture Hrs: 12

Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

24. Python program to check whether a JSON string contains complex object or not.
25. Python Program to demonstrate NumPy arrays creation using array () function.
26. Python program to demonstrate use of ndim, shape, size, dtype.
27. Python program to demonstrate basic slicing, integer and Boolean indexing.
28. Python program to find min, max, sum, cumulative sum of array
29. Create a dictionary with at least five keys and each key represent value as a list where thi list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
    a) Apply head () function to the pandas data frame
    b) Perform various data selection operations on Data Frame
30. Select any two columns from the above data frame, and observe the change in one attribut with respect to other attribute with scatter and plot operations in matplotlib.

References:

1. Gowri Shankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

		L	T	P	C
23BTCE01A	**Environmental Science (Audit Course) (Common to All Branches)**	**2**	**0**	**0**	**-**

Course Objectives:

- To make the students to get awareness on environment.
- Tounderstandtheimportanceofprotectingnaturalresources,ecosystemsforfuturegeneration sandpollutioncausesduetotheday-to-dayactivitiesofhumanlife
- To save earth from the inventions by the engineers.
- Assess the sustainability of various human practices in terms of resource use and waste management.
- To apply theoretical knowledge to real-world environmental challenges through experiential learning opportunities

Course Outcomes:

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

CO	Statement
CO1	Comprehend the concepts of environment and its importance in our daily life and develop and apply various water conservation methods and conservation of other natural resources also.
CO2	Identify the importance of environmental education for protection of life cycles of various bio systems which are essential for bio sphere.
CO3	Develop new innovative methods for controlling of environmental pollution which may affect the human health.
CO4	Analyze environmental issues related to society and find solutions for environmental problems.
CO5	Analyze the effects of increasing human population as well as health associated problems and develops measures to be taken to protect human health.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3	3							
CO2						3	3							
CO3						3	3							
CO4						3	3							
CO5						3	3							

UNITI

Multidisciplinary Nature of Environmental Studies: – Definition, Scope, and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and usingmineralresources,casestudies–

Foodresources:Worldfoodproblems,changescausedbyagricultureandovergrazing,effectsofmo

dernagriculture,fertilizer-pesticideproblems,waterlogging,salinity,casestudies.–
Energyresources:

UNITII

Ecosystems: Concept of an ecosystem.–Structure and function of an ecosystem –Producers, consumers, and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains,foodwebsandecologicalpyramids–
Introduction,types,characteristicfeatures,structure,andfunctionofthe following ecosystem:

a. Forest ecosystem.
b. Grassl and ecosystem
c. Desert ecosystem.
d. Aquatic ecosystems(ponds, streams, lakes, rivers, oceans, estuaries)

BiodiversityanditsConservation: Introduction0Definition:genetic,speciesandecosystemdiversity–Bio-geographicalclassificationofIndia–Valueofbiodiversity:consumptiveuse,Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wild life, man-wildlife conflicts– Endangered and endemic species of India–Conservation of bio diversity: In-situ and Ex-situ conservation of biodiversity.

UNITIII

EnvironmentalPollution: Definition,Cause,effects,andcontrolmeasuresof:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes**,** effects, and control measures of urban and industrial wastes –Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earth quake, cyclone and landslides.

UNITIV

Social Issues and the Environment: From Unsustainable to Sustainable development– Urban problems related to energy – Water conservation, rain water harvesting, watershed management –Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain,ozone layer depletion, nuclear accidents, and holocaust.Case Studies – Wasteland reclamation. – Consumerismand waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution)Act. –Water(PreventionandcontrolofPollution)Act– WildlifeProtectionAct–ForestConservationAct–
Issuesinvolvedinenforcementofenvironmentallegislation–Publicawareness.

UNITV

Human Population and the Environment: Population growth, variation among nations.Populationexplosion – Family Welfare Programmes. – Environment and human health – Human Rights – ValueEducation–HIV/AIDS–WomenandChildWelfare– RoleofinformationTechnologyinEnvironmentandhumanhealth–Casestudies.

FieldWork: Visittoalocalareatodocumentenvironmentalassets River/forestgrassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study ofcommonplants,insects,andbirds–river,hillslopes,etc.

Textbooks:

1. TextbookofEnvironmentalStudiesforUndergraduateCoursesErachBharuchaforUniversityGrantsCommission,UniversitiesPress.
2. Palaniswamy,―EnvironmentalStudies‖,Pearsoneducation
3. S.AzeemUnnisa,―EnvironmentalStudies‖AcademicPublishingCompany

4. K.RaghavanNambiar,―TextbookofEnvironmentalStudiesforUndergraduateCoursesasperUGCmodelsyllabus‖,ScitechPublications(India),Pvt.Ltd.

References:

1. DeekshaDaveandE.SaiBabaReddy,―TextbookofEnvironmentalScience‖,CengagePublications.
2. M.AnjiReddy, ―TextbookofEnvironmentalSciencesandTechnology‖, BS Publication.
3. J.P.Sharma,ComprehensiveEnvironmentalstudies,Laxmipublications.
4. J.GlynnHenryandGaryW.Heinke,―EnvironmentalSciencesandEngineering‖,PrenticeHallofIndiaPrivatelimited
5. G.R.Chatwal, ―AText BookofEnvironmentalStudies‖HimalayaPublishingHouse
6. GilbertM.MastersandWendellP.Ela,―IntroductiontoEnvironmentalEngineeringandScience,Prentice HallofIndiaPrivatelimited.

Web Materials:

1. https://www.coursera.org/learn/python-for-applied-data-science-ai
2. https://www.coursera.org/learn/python?specialization=python#syllabus

II B.Tech II Sem (E.C.E)

23BTBA02T	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	L	T	P	C
		2	0	0	2

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes (CO): Student will be able to

CO 1 – Understand the fundamental concepts of Economics viz., Demand, Production, cost, revenue and markets. CO 2 – Apply the Concepts of Production and cost analysis for effective Business decision making

CO 3 – Understand the different forms of business, markets and pricing methods.

CO 4 – Analyze the investment opportunities with capital budgeting techniques to maximize returns

CO 5 – Apply double entry system to prepare accounting statements and evaluate the financial performance of business entity

UNIT – I: Managerial Economics Lecture Hrs: 12

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting Factors governing Forecasting, Methods.
Managerial Economics and Financial Accounting and Management.

UNIT – II: Production and Cost Analysis Lecture Hrs: 12

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis -
Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT – III: Business Organizations and Markets Lecture Hrs: 12

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public
Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT – IV: Capital Budgeting Lecture Hrs: 12

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate
Return (IRR) Method (sample problems).

UNIT – V: Financial Accounting and Analysis Lecture Hrs: 12

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios
and Profitability.

Textbooks:

- Varshney & Maheswari: Managerial Economics, Sultan Chand.
- Aryasri: Business Economics and Financial Analysis, 4/e, MGH.
- Ahuja Hl Managerial economics Schand.
- S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
- Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
- Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt. https://www.slideshare.net/rossanz/production-and- cost-45827016. https://www.slideshare.net/darkyla/business-organizations-19917607. https://www.slideshare.net/balarajbl/market-and-classification-of-market. https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396. https://www.slideshare.net/ashu1983/financial-accounting.

II B.Tech II Sem (E.C.E)

23BTBA03T	ORGANISATIONAL BEHAVIOUR	L	T	P	C
		2	0	0	2

Course Objectives:

- To enable student's comprehension of organizational behavior
- To offer knowledge to students on self-motivation, leadership and management
- To facilitate them to become powerful leaders
- To Impart knowledge about group dynamics
- To make them understand the importance of change and development

Course Outcomes (CO): Student will be able to

CO 1 – Understand basic concepts of organisation and individual behaviour in the organisation CO 2 – Apply theories of motivation in the real time business management

CO 3 – Understand the organizational culture and qualities of leader

CO4 – Apply group decision making and team building practices in the real time business management CO 5 – Understand Organisational change management practices

UNIT – I: Introduction to Organizational Behavior Lecture Hrs: 06

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective - Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.

UNIT – II: Motivation and Leading Lecture Hrs: 06

Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Cleland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory.

UNIT – III: Organizational Culture Lecture Hrs: 06

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader.

UNIT – IV: Group Dynamics Lecture Hrs: 06

Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behaviour - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution

UNIT – V: Organizational Change and Development Lecture Hrs: 06

Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

Textbooks:

- Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition.
- P Subba Ran, Organisational Behaviour, Himalya Publishing House.
- McShane, Organizational Behaviour, TMH.
- Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson.

Online Learning Resources:

https://www.slideshare.net/Knight1040/organizational-culture

9608857s://www.slideshare.net/AbhayRajpoot3/motivation-165556714 https://www.slideshare.net/harshrastogi1/group-dynamics-159412405

https://www.slideshare.net/vanyasingla1/organizational-change-development-26565951

II B.Tech II Sem (E.C.E)

23BTBA04T	**BUSINESS ENVIRONMENT**	L	T	P	C
		2	0	0	2

Course Objectives:

- To make the student to understand about the business environment
- To enable them in knowing the importance of fiscal and monitory policy
- To facilitate them in understanding the export policy of the country
- To Impart knowledge about the functioning and role of WTO
- To Encourage the student in knowing the structure of stock markets

Course Outcomes (CO): Student will be able to

CO 1 – Understand the preliminary concepts of business environment
CO 2 – Understand fiscal and monetary policy that affect the business environment CO 3 – Understand the national and international trade policy of India
CO 4 – Explain about WTO, EXIM and balance of payment
CO 5 – Understand money market and capital market, role of SEBI and stock exchanges

UNIT – I: Overview of Business Environment Lecture Hrs: 06

Introduction – meaning Nature, Scope, significance, functions and advantages. Types Internal &External, Micro and Macro. Competitive structure of industries -Environmental analysis- advantages & limitations of environmental analysis.

UNIT – II: Fiscal & Monetary Policy Lecture Hrs: 06

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget Monetary Policy - Demand and Supply of Money – RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.

UNIT – III: India's Trade Policy Lecture Hrs: 06

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

UNIT – IV: World Trade Organization Lecture Hrs: 06

Introduction – Nature, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round – TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

UNIT – V: Money Markets and Capital Markets Lecture Hrs: 06

Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges - Investor protection and role of SEBI, Introduction to international finance.

Textbooks:

- Francis Cherunilam, International Business: Text and Cases, Prentice Hall of India.
- K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition.HPH.
- K. V. Sivayya, V. B. M Das, Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
- Sundaram, Black, International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.

Online Learning Resources:

https://www.slideshare.net/ShompaDhali/business-environment-53111245
https://www.slideshare.net/rbalsells/fiscal-policy-ppt
https://www.slideshare.net/aguness/monetary-policy-presentationppt
https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982
https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt

II B.Tech II Sem (E.C.E)

23BTEE08T	**LINEAR CONTROL SYSTEMS**	L	T	P	C
		3	0	0	3

Course Objectives:

- Introduce the basic principles and applications of control systems.
- Learn the time response and steady-state response of systems.
- Know the time-domain analysis and solutions to time-invariant systems.
- Understand different aspects of stability analysis of systems in the frequency domain.
- Understand the concept of state space, controllability, and observability.

Course Outcomes (CO): Student will be able to

- Apply the basic principles and applications of control systems for representing various reduction techniques.
- Determine the characteristics of a linear control system using various time response and steady state response of the systems.
- Analyze the concept of state space, controllability and observability.
- Apply time domain analysis to find solutions to time invariant systems.
- Analyze different aspects of stability analysis of systems in frequency domain.

UNIT – I Lecture Hrs: 06

Control systems concepts: Open loop and closed loop control systems and their differences—examples of control systems—classification of control systems—feedback characteristics—effects of positive and negative feedback. Mathematical models—differential equations of translational and rotational mechanical systems and electrical systems—analogous systems. Block diagram reduction methods—signal flow graphs—reduction using Mason's gain formula. Controller components—DC servomotor and AC servomotor and their transfer functions—synchros.

UNIT – II Lecture Hrs: 06

Time Response Analysis: Step response, impulse response, time response of first-order systems—characteristic equation of feedback control systems, transient response of second- order systems—time domain specifications—steady-state response—steady-state errors and error constants. Study of effects and design of P, PI, PD, and PID controllers on a second-order system.

UNIT – III Lecture Hrs: 06

Stability Analysis in Time Domain: The concept of stability—Routh's stability criterion—stability and conditional stability—limitations of Routh's stability. The root locus concept—construction of root loci—effects of adding poles and zeros to $(G(s)H(s))$ on the root loci.

UNIT – IV Lecture Hrs: 06

Frequency Response Analysis: Introduction, frequency domain specifications—Bode diagrams—determination of frequency domain specifications and transfer function from the Bode diagram—stability analysis from Bode plots. Polar plots, Nyquist plots, phase margin and gain margin—stability analysis. Compensation techniques—study of effects and design of lag, lead, and lag-lead compensators in the frequency domain on a second-order system.

UNIT – V Lecture Hrs: 06

State-space analysis of continuous systems: Concepts of state, state variables, and state model; differential equations & transfer function models; block diagrams. Diagonalization, transfer function from state model, solving the time-invariant state equations; state transition matrix and its properties. System response through state-space models. The concepts of controllability and observability.

Textbooks:

1. *Modern Control Engineering* by Katsuhiko Ogata, Prentice Hall of India Pvt. Ltd., 5th Edition, 2010.
2. *Control Systems Engineering* by I. J. Nagrath and M. Gopal, New Age International (P) Limited Publishers, 5th Edition, 2007.

References:

1. *Control Systems Principles & Design* by M. Gopal, 4th Edition, McGraw Hill Education, 2012.
2. *Automatic Control Systems* by B. C. Kuo and Farid Golnaraghi, 8th Edition, John Wiley & Sons, 2003.

3. *Feedback and Control Systems* by Joseph J. Distefano III, Allen R. Stubberud, & Ivan J. Williams, 2nd Edition, Schaum's Outlines, McGraw Hill Education, 2013.
4. *Control System Design* by Graham C. Goodwin, Stefan F. Graebe, and Mario E. Salgado, Pearson, 2000.
5. *Feedback Control of Dynamic Systems* by Gene F. Franklin, J. D. Powell, and Abbas Emami-Naeini, 6th Edition, Pearson, 2010.

Online Learning Resources:

https://www.slideshare.net/ShompaDhali/business-environment-53111245 https://www.slideshare.net/rbalsells/fiscal-policy-ppt https://www.slideshare.net/aguness/monetary-policy-presentationppt https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982 https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt

II B.Tech II Sem (E.C.E)

23BTEC04T	**EM Waves and Transmission Lines**	L	T	P	C
		3	0	0	3

Course Objectives:

- To understand and analyze different laws and theorems of electrostatic fields.
- To study and analyze different laws and theorems of magnetostatic fields.
- To analyze Maxwell's equations in different forms.
- To learn the concepts of wave theory and its propagation through various mediums.
- To gain exposure to the properties of transmission lines

Course Outcomes (CO): Student will be able to

- Explain the concepts of wave theory and its propagation through various mediums. (L2)
- Understand the properties of transmission lines and their applications. (L2)
- Apply the laws and theorems of electrostatic fields to solve related problems. (L3)
- Gain proficiency in the analysis and application of magnetostatic laws and theorems. (L4)
- Analyze Maxwell's equations in different forms. (L4)

UNIT – I Lecture Hrs: 06

Review of coordinate systems; **Electrostatics:** Coulomb's Law, electric field intensity, electric flux density, Gauss's Law and applications, electric potential, Maxwell's two equations for electrostatic fields, energy density; illustrative problems. Convection and conduction currents, dielectric constant, Poisson's and Laplace's equations; capacitance—parallel plate, coaxial capacitors; illustrative problems.

UNIT – II Lecture Hrs: 06

Magnetostatics: Biot-Savart Law, Ampere's Circuital Law and applications, magnetic flux density, Maxwell's two equations for magnetostatic fields, magnetic scalar and vector potentials, forces due to magnetic fields, Ampere's force law, inductances and magnetic energy, illustrative problems.

Maxwell's Equations (Time Varying Fields): Faraday's Law and transformer EMF; inconsistency of Ampere's Law and displacement current density; Maxwell's equations in different final forms and word statements; conditions at a boundary surface; illustrative problems.

UNIT – III Lecture Hrs: 06

EM Wave Characteristics: Wave equations for conducting and perfect dielectric media; uniform plane waves—definition, all relations between E & H, sinusoidal variations; wave propagation in lossy dielectrics, lossless dielectrics, free space, wave propagation in good conductors, skin depth; polarization & types; illustrative problems.

Reflection and refraction of plane waves—normal and oblique incidences, for both perfect conductors and perfect dielectrics; Brewster angle, critical angle and total internal reflection; surface impedance; Poynting vector and Poynting theorem; illustrative problems.

UNIT – IV Lecture Hrs: 06

Transmission Lines-I:Types, parameters, T & π equivalent circuits, transmission line equations, primary & secondary constants, expressions for characteristic impedance, propagation constant, phase and group velocities, infinite line, lossless lines, distortionless lines, illustrative problems.

UNIT – V Lecture Hrs: 06

Transmission Lines– II: Input impedance relations, reflection coefficient, VSWR, average power, shorted lines, open-circuited lines, and matched lines; low-loss radio frequency and UHF transmission lines; UHF lines as circuit elements; Smith Chart—construction and applications; quarter-wave transformer; single stub matching; illustrative problems.

Textbooks:

1. *Elements of Electromagnetics*, Matthew N. O. Sadiku, 4th Edition, Oxford University Press, 2008.
2. *Electromagnetic Waves and Radiating Systems*, E. C. Jordan and K. G. Balmain, 2nd Edition, PHI, 2000.

References:

1. *Electromagnetic Field Theory and Transmission Lines*, G. S. N. Raju, 2nd Edition, Pearson Education, 2013.
2. *Engineering Electromagnetics*, William H. Hayt Jr. and John A. Buck, 7th Edition, Tata McGraw-Hill, 2006.
3. *Electromagnetics*, John D. Krauss, 3rd Edition, McGraw-Hill, 1988.
4. *Networks, Lines, and Fields*, John D. Ryder, 2nd Edition, PHI Publications, 2012.

Online Learning Resources:

II B.Tech II Sem (E.C.E)

23BTEC05T	**ELECTRONIC CIRCUITS ANALYSIS**	L	T	P	C
		3	0	0	3

Course Objectives: ;

- Understand the characteristics of differential amplifiers, feedback amplifiers, and power amplifiers.
- Analyze the response of tuned amplifiers.
- Categorize different oscillator circuits based on the application.
- Design electronic circuits for the given specifications and for a given application.

Course Outcomes (CO): Student will be able to

- Apply the characteristics of differential amplifiers, feedback amplifiers, and power amplifiers. (L3)
- Examine the frequency response of multistage and differential amplifier circuits using BJTs and MOSFETs at low and high frequencies. (L3)
- Investigate different feedback and power amplifier circuits based on the application. (L4)
- Derive the expressions for the frequency of oscillation and conditions for oscillation of RC and LC oscillator circuits. (L4)
- Evaluate the performance of different tuned amplifiers. (L5)
- Design analog circuits for the given specifications and applications. (L6)

UNIT – I Lecture Hrs: 06

Multistage & Differential Amplifiers: Introduction, Classification of Amplifiers, Distortion in Amplifiers, Coupling Schemes, RC Coupled Amplifier using BJT, Cascaded RC Coupled BJT Amplifiers, Cascode Amplifier, Darlington Pair, the MOS Differential Pair, Small-Signal Operation of the MOS Differential Pair, the BJT Differential Pair, and Other Non-Ideal Characteristics of the Differential Amplifier.

UNIT – II Lecture Hrs: 06

Frequency Response: Low-Frequency Response of the CS and CE Amplifiers, Internal Capacitive Effects and the High-Frequency Model of the MOSFET and the BJT, High-Frequency Response of the CE, Emitter Follower, CS, CD, (f_β), (f_T), and Gain-Bandwidth Product.

UNIT – III Lecture Hrs: 06

Feedback Amplifiers: Introduction, The General Feedback Structure, Some Properties of Negative Feedback, The Four Basic Feedback Topologies – Series-Shunt, Series-Series, Shunt-Shunt, Shunt-Series.

Oscillators: General Considerations, Phase Shift Oscillator, Wien-Bridge Oscillator, LC Oscillators, Relaxation Oscillator, Crystal Oscillators, Illustrative Problems.

UNIT – IV Lecture Hrs: 06

Power Amplifiers: Introduction, Classification of Output Stages, Class A Output Stage, Class B Output Stage, Class AB Output Stage, Biasing the Class AB Circuit, CMOS Class AB Output Stages, Power BJTs, Variations on the Class AB Configuration, MOS Power Transistors.

UNIT – V Lecture Hrs: 06

Tuned Amplifiers: Introduction, Single-Tuned Amplifiers – Q-factor, Frequency Response, Double-Tuned Amplifiers – Q-factor, Frequency Response, Concept of Stagger Tuning and Synchronous Tuning.

Multivibrators: Analysis and Design of Bistable, Monostable, Astable Multivibrators and Schmitt Trigger using Transistors.

Textbooks:

1. Adel. S. Sedra and Kenneth C. Smith, ―Micro Electronic Circuits,‖ 6th Edition, OxfordUniversityPress,2011.
2. J. Millman, H. TaubandMothikiS. Prakash Rao - Pulse, Digital and Switching Waveforms–2nd Ed., TMH,2008.
3. Millman, C Chalkias,―IntegratedElectronics‖,4thEdition, McGraw Hill Education (India)PrivateLtd.,2015.

References:

1. Behzad Razavi, ―Fundamentals of MicroElectronics‖,Wiley,2010.
2. Donald A Neamen,― Electronic Circuits–Analysis and Design,‖3rdEdition, McGraw Hill(India),2019.
3. Robert L.Boylestad and Louis Nashelsky,― Electronic Devices and Circuits Theory‖, 9th Edition, Pearson / Prentice Hall,2006.

II B.Tech II Sem (E.C.E)

23BTEC06T	**ANALOG AND DIGITAL COMMUNICATIONS**	L	T	P	C
		3	0	0	3

Course Objectives:

- Introduce various modulation and demodulation techniques of analog and digital communication systems.
- Analyze different parameters of analog and digital communication techniques.
- Understand the function of various stages of AM and FM transmitters and know the characteristics of AM and FM receivers.
- Analyze the performance of various digital modulation techniques in the presence of AWGN.

Course Outcomes (CO): Student will be able to

- Recognize the basic terminology used in analog and digital communication techniques for the transmission of information/data. (L1)
- Explain the basic operation of different analog and digital communication systems at baseband and passband levels. (L2)
- Compute various parameters of baseband and passband transmission schemes by applying basic engineering knowledge. (L3)
- Analyze the performance of different modulation and demodulation techniques to solve complex problems in the presence of noise. (L4)
- Evaluate the performance of all analog and digital modulation techniques to understand the merits and demerits of each in terms of bandwidth and power efficiency. (L5)

UNIT – I Lecture Hrs: 06

Amplitude Modulation: Need for Modulation, Amplitude Modulation - Time and Frequency Domain Description, Single-tone Modulation, Power Relations in AM Waves, Generation of AM Waves - Switching Modulator, Detection of AM Waves - Envelope Detector. DSBSC Modulation: Time and Frequency Domain Description, Generation of DSBSC Waves - Balanced Modulators, Coherent Detection of DSB-SC Modulated Waves, COSTAS Loop. SSB Modulation: Time and Frequency Domain Description, Frequency Discrimination and Phase Discrimination Methods for Generating SSB, Demodulation of SSB Waves, Principle of Vestigial Sideband Modulation.

UNIT – II Lecture Hrs: 06

Angle Modulation: Basic concepts of Phase Modulation, Frequency Modulation: Single-tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave using Bessel functions, Narrowband FM, Wideband FM, Constant Average Power, Transmission Bandwidth of FM Wave, Generation of FM Signal - Armstrong Method, Detection of FM Signal: Balanced Slope Detector, Phase-Locked Loop, Comparison of FM and AM, Concept of Pre-emphasis and De-emphasis.

UNIT – III Lecture Hrs: 06

Transmitters: Classification of Transmitters, AM Transmitters, FM Transmitters.
Receivers: Radio Receiver - Receiver Types - Tuned Radio Frequency Receiver, Superheterodyne Receiver; RF Section and Characteristics - Frequency Changing and Tracking, Intermediate Frequency, Image Frequency, AGC, Amplitude Limiting; FM Receiver; Comparison of AM and FM Receivers.

UNIT – IV Lecture Hrs: 06

Introduction to Noise includes the types of noise, the receiver model, and noise characteristics in AM, DSB, SSB, and FM receivers.
Sampling and its types, sampling theorem- Pulse Modulation includes various types such as PAM, PWM, and PPM, along with a comparison of FDM and TDM. Pulse Code Modulation (PCM) covers PCM generation and reconstruction, quantization noise, non-uniform quantization and companding, delta modulation, differential PCM (DPCM), and noise in PCM and DM.

UNIT – V Lecture Hrs: 06

Digital Modulation Techniques: Coherent Digital Modulation Schemes – ASK, BPSK, BFSK, QPSK; Non-coherent BFSK, DPSK; M-ary Modulation Techniques, Power Spectra, Bandwidth Efficiency.

Baseband Transmission and Optimal Reception of Digital Signal: A Baseband Signal Receiver, Probability of Error, Optimum Receiver, Coherent Reception, ISI, Eye Diagrams.

Textbooks:

1. Simon Haykin,―Communication Systems‖,JohnWiley&Sons,4th Edition,2004.
2. Wayne Tomasi ―Electronics Communication Systems-Fundamentals through Advanced‖, 5th Ed., PHI,2009
3. B.P. Lathi, Zhi Ding― Modern Digital and Analog Communication Systems‖, Oxford press,2011.

References:

1. Sam Shanmugam,― Digital and Analog Communication Systems‖,JohnWiley&Sons,1999.
2. Bernard Sklar, F. J. Harris ―Digital Communications: Fundamentals and Applications‖, Pearson Publications, 2020.
3. Taub and Schilling,― Principles of Communication Systems‖,TataMcGrawHill,2007.

II B.Tech II Sem (E.C.E)

23BTEC03P	**ELECTRONIC CIRCUITS ANALYSIS LAB**	L	T	P	C
		0	0	3	1.5

Course Objectives:

- Plot the characteristics of differential amplifiers, feedback, and power amplifiers.
- Analyze the response of tuned amplifiers and multivibrators.
- Categorize different oscillator circuits based on the application.
- Design the electronic circuits for the given specifications and for a given application.

Course Outcomes (CO): Student will be able to

- Know about the usage of equipment, components, and software tools used to conduct experiments in analog circuits. (L2)
- Conduct the experiment based on the knowledge acquired in the theory about various analog circuits using BJT/MOSFETs to find the important parameters of the circuit experimentally. (L3)
- Analyze the given analog circuit to find required important metrics of it theoretically. (L4)
- Compare the experimental results with the theoretical ones and infer the conclusions. (L4)
- Design the circuit for the given specifications. (L5)

List of Experiments Lecture Hrs: 06

1. Design and Analysis of Darlington Pair
2. Frequency Response of CE–CC Multistage Amplifier
3. Design and Analysis of Cascode Amplifier
4. Frequency Response of Differential Amplifier
5. Design and Analysis of any two topologies of feedback amplifiers and find the frequency response of it
6. Design and Analysis of Class A Power Amplifier
7. Design and Analysis of Class AB Amplifier
8. Design and Analysis of RC Phase Shift Oscillator
9. Design and Analysis of LC Oscillator
10. Frequency Response of Single Tuned Amplifier
11. Design a Bistable Multivibrator and analyze the effect of commutating capacitors and draw the waveforms at base and collector of transistors
12. Design an Astable Multivibrator and draw the waveforms at base and collector of transistors
13. Design a Monostable Multivibrator and draw the input and output waveforms
14. Draw the response of Schmitt Trigger for gain of greater than and less than one

Note

- At least 12 experiments shall be performed.
- Faculty members who are handling the laboratory shall ensure that students are given design specifications for a given circuit appropriately and monitor the design and analysis aspects of the circuit.

II B.Tech II Sem (E.C.E)

23BTEC04P	**ANALOG AND DIGITAL COMMUNICATIONS LAB**	L	T	P	C
		0	0	3	1.5

Course Objectives:

- Understand the basics of analog and digital modulation techniques.
- Integrate theory with experiments so that the students appreciate the knowledge gained from the theory course.
- Design and implement different modulation and demodulation techniques and their applications.
- Develop cognitive and behavioral skills for performance analysis of various modulation techniques.

Course Outcomes (CO): Student will be able to

- Know about the usage of equipment, components, and software tools used to conduct experiments in analog and digital modulation techniques. (L2)
- Conduct experiments based on the knowledge acquired in the theory about modulation and demodulation schemes to find the important metrics of the communication system experimentally. (L3)
- Analyze the performance of a given modulation scheme to find the important metrics of the system theoretically. (L4)
- Compare the experimental results with the theoretical ones and infer conclusions. (L4)

Section-A

1. AM Modulation and Demodulation
2. DSB-SC Modulation and Demodulation
3. Frequency Division Multiplexing
4. FM Modulation and Demodulation
5. Radio Receiver Measurements
6. PAM Modulation and Demodulation
7. PWM Modulation and Demodulation
8. PPM Modulation and Demodulation

Section-B

1. Sampling Theorem.
2. Time Division Multiplexing
3. Delta Modulation and Demodulation
4. PCM Modulation and Demodulation
5. BPSK Modulation and Demodulation
6. BFSK Modulation and Demodulation
7. QPSK Modulation and Demodulation
8. DPSK Modulation and Demodulation

Note

- Design the circuits and verify the following experiments, taking a minimum of six from each section shown below:
- Faculty members (who are handling the laboratory) are requested to instruct the students not to use ready-made kits for conducting the experiments. They are advised to make the students work in the laboratory by constructing the circuits and analyzing them during the lab sessions.

II B.Tech II Sem (E.C.E)

23BTHS14T	**SOFT SKILLS**	L	T	P	C
		0	1	2	2

Course Objectives:

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To enhance healthy relationship and understanding within and outside an organization
- To function effectively with heterogeneous teams

Course Outcomes (CO): Student will be able to

- List out various elements of soft skills (L1, L2)
- Describe methods for building professional image (L1, L2)
- Apply critical thinking skills in problem solving (L3)
- Analyze the needs of an individual and team for well-being (L4)
- Assess the situation and take necessary decisions (L5)
- Create a productive workplace atmosphere using social and work-life skills ensuring personal and emotional well-being (L6)

UNIT – I : Soft Skills & Communication Skills — Lecture Hrs: 06

Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills - Significance, process, types - Barriers of communication - Improving techniques.

Activities: Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity.

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication - Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non- verbal Communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation.

UNIT II : Critical Thinking — Lecture Hrs: 06

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking – Reflection

Activities: Gathering information and statistics on a topic - sequencing – assorting – reasoning critiquing issues –placing the problem – finding the root cause - seeking viable solution –judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT III : Problem Solving & Decision Making — Lecture Hrs: 06

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Teambuilding - Effective decision making in teams – Methods & Styles

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion.

UNIT IV : Emotional Intelligence & Stress Management — Lecture Hrs: 06

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness –Self-Regulation – Stress factors – Controlling Stress – Tips.

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates.

UNIT V : Corporate Etiquette — Lecture Hrs: 06

Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette,

benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips -Overcoming challenges-Leadership skills.

Activities

Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games-planing- motivation-risk taking-public speaking-stellar communication

Textbooks:

1. Sharma, Prashant, Soft Skills: Personality Development for Life Success, BPB Publications 2018.
2. Alex K, Soft Skills S.Chand& Co, 2012 (Revised edition).
3. Gajendra Singh Chauhan & Sangeetha Sharma, Soft Skills: An Integrated Approach to Maximise Personality Published by Wiley, 2013.
4. Pillai, Sabina & Fernandez Agna, Soft Skills and Employability Skills, Cambridge University Press, 2018.
5. Soft Skills for a Big Impact (English, Paperback, Renu Shorey) Publisher: NotionPress.
6. Dr. Rajiv Kumar Jain, Dr. Usha Jain, Life Skills (Paperback English) Publisher: Vayu Education of India, 2014.

Online resources

References:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc
7. https://www.businesstrainingworks.com/training-resource/five-free-business- etiquette-training-games/
8. https://onlinecourses.nptel.ac.in/noc24_hs15/preview
9. https://onlinecourses.nptel.ac.in/noc21_hs76/preview

II B.Tech II Sem (E.C.E)

23BTME09T	**DESIGN THINKING AND INNOVATION**	L	T	P	C
		1	0	2	2

Course Objectives:

The objective of this course is to familiarize students with the design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes (CO): Student will be able to

- Apply the basic principles of design thinking.
- Apply the design thinking techniques for solving problems in various sectors.
- Appreciate the difference between innovation and creativity.
- Apply the techniques of product design to develop a new product.
- Apply design thinking techniques for business models and startups.

UNIT – I Introduction to Design Thinking — Lecture Hrs: 06

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT II Design Thinking Process — Lecture Hrs: 06

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT III Innovation — Lecture Hrs: 06

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT IV Product Design — Lecture Hrs: 06

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT V Design Thinking in Business Processes — Lecture Hrs: 06

Design Thinking applied in Business &Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs- Design thinking for Startups- Defining and testing Business Models and Business Cases- Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks:

1. David Lee, Design Thinking in the Classroom, Ulysses press
2. Shruti N Shetty, Design the Future, Norton Press
3. William Lidwell, Universal Principles of Design-Kritinaholden, Jill Butter.
4. Chesbrough.H, The Era of Open Innovation – 2013

Online resources

Online Learning Resources: https://nptel.ac.in/courses/110/106/110106124/
https://nptel.ac.in/courses/109/104/109104109/
https://swayam.gov.in/nd1_noc19_mg60/pre

II B.Tech II Sem (E.C.E)

Title of the Subject-23A49903

COMMUNITY SERVICE PROJECT

Experiential learning through community engagement

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning, and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit from the focused contribution of the college students for the village/local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships/Apprenticeships/On the Job Training; whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people around them.
- To help students realize the stark realities of society.
- To bring about an attitudinal change in students and help them develop societal consciousness, sensibility, responsibility, and accountability.
- To make students aware of their inner strength and help them find new or out-of-the-box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of disadvantaged sections.
- To help students initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and their management, social problems, public administration systems, and the roles and responsibilities of different persons across various social systems.

Implementation of Community Service Project

- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned a mentor.
- Specific departments could concentrate on their major areas of concern. For example, the Department of Computer Science can take up activities related to computer literacy for different sections of people such as youth, women, housewives, etc.
- A logbook must be maintained by each student, where the activities undertaken/involved are to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.
- An evaluation is to be done based on the active participation of the student, and a grade could be awarded by the mentor/faculty member.
- The final evaluation is to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of internship/apprentice/on-the-job training.

Procedure

- A group of students or even a single student could be assigned to a particular habitation, village, or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.

The Community Service Project is twofold:

- First, the student(s) could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the village or ward volunteers; rather, it could be another primary source of data.
- Secondly, the student(s) could take up a social activity concerning their domain or subject area. The different areas could include:–
    - Agriculture
    - Health
    - Marketing and Cooperation
    - Animal Husbandry
    - Horticulture
    - Fisheries
    - Sericulture
    - Revenue and Survey
    - Natural Disaster Management
    - Irrigation
    - Law & Order
    - Excise and Prohibition
    - Mines and Geology
    - Energy
    - Internet
    - Free Electricity
    - Drinking Water

EXPECTEDOUTCOMES

Benefits of Community Service Project to Students:

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in the real world
- Positive impact on academic outcomes, such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

- Reduced stereotypes and greater intercultural understanding
- Improved social responsibility and citizenship skills
  Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunities

Relationship with the Institution

- - Stronger relationships with faculty
- - Greater satisfaction with college
- - Improved graduation rates

Benefits of Community Service Project to Faculty Members:

- Satisfaction with the quality of student learning

- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

BENEFITSOF COMMUNITYSERVICE PROJECT TOCOMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm, and perspectives applied to community work
- Enhanced community-university relations

SUGGESTIVE LIST OF PROGRAMMESUNDERCOMMUNITYSERVICE PROJECT

The following is the recommended list of projects for engineering students. The lists are not exhaustive and are open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for these projects. Students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. Mentors for a group of students should take the responsibility of motivating, facilitating, and guiding the students. They need to interact with local leadership and people and appraise the objectives and benefits of these projects. The project reports should be placed on the college website for reference. Systematic, factual, methodical, and honest reporting should be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programs
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aquaculture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional healthcare methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Healthcare awareness programs and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Floriculture
28. Access to safe drinking water
29. Geographical survey

30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet usage in villages
38. Android phone usage by different people
39. Utilization of free electricity by farmers and related issues
40. Gender ration in schooling level - observation

Complementing the community service project, students may be involved in taking up some awareness campaigns on social issues or special groups. The suggested list of programs

- Programs for School Children
- Reading Skill Program (Reading Competition)
- Preparation of Study Materials for the Next Class
- Personality/Leadership Development
- Career Guidance for X Class Students
- Screening Documentaries and Other Educational Films
- Awareness Program on Good Touch and Bad Touch (Sexual Abuse)
- Awareness Program on Socially Relevant Themes

Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical Camps
2. Eye Camps
3. Dental Camps
4. Importance of Protected Drinking Water
5. ODF Awareness Camp
6. Swachh Bharat
7. AIDS Awareness Camp
8. Anti-Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Handwash Programs
12. Commemoration and Celebration of Important Days

Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug Addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development Common Programs
    1. Awareness on RTI
    2. Health Intervention Programmes
    3. Yoga
    4. Tree Plantation
    5. Programs in Consonance with Government Departments like: –
        i. Agriculture
        ii. Health
        iii. Marketing and Cooperation
        iv. Animal Husbandry

v. Horticulture
vi. Fisheries
vii. Sericulture
viii. Revenue and Survey
ix. Natural Disaster Management
x. Irrigation
xi. Law & Order
xii. Excise and Prohibition
xiii. Mines and Geology
xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the programs on their own. They can play a facilitator role.
- For conducting special camps, such as health-related ones, students will coordinate with government agencies.
- When required, college faculty may act as resource persons.
- Students can work in close association with Non-Governmental Organizations (NGOs) like Lions Club, Rotary Club, or any NGO actively working in that habitation.
- Collaboration with governmental departments is also encouraged. If the program is rolled out, the District Administration could be involved for successful deployment.
- An in-house training and induction program could be arranged for faculty and participating students to expose them to the methodology of service learning.

Timeline for the Community Service Project Activity

Duration:8weeks

1. **Preliminary Survey (One Week)**
   - Conduct a preliminary survey to assess the socio-economic conditions of the allotted habitation.
   - Prepare a survey form based on the type of habitation before visiting, with assistance from social sciences faculty. (Templates can be designed for different types of habitations, such as rural or urban.)
   - Align with governmental agencies, including revenue administration, corporation and municipal authorities, and village secretariats, for the survey.
2. **Community Awareness Campaigns (One Week)**
   - Based on the survey and the specific requirements of the habitation, different awareness campaigns and programs should be conducted, spread over two weeks of time. The list of suggested activities could be considered.
3. **Community Immersion Programme (Three Weeks)**
   Along with the Community Awareness Programmes,
   - The student batch can also work with any of the below-listed governmental agencies and collaborate with them. This community involvement program will engage students in experiential learning about the community and its dynamics.
   - Programs could be in consonance with the Government Departments.
4. **Community Exit Report(One Week)**
   - During the last week of the Community Service Project, a detailed report of the outcomes from the 8 weeks of work should be drafted and submitted to the local administration. This report will serve as a basis for the next batch of students visiting that habitation.
   - The same report submitted to the teacher-mentor will be evaluated by the mentor, and suitable marks will be awarded for onward submission to the university.
   - Throughout the Community Service Project, students must maintain a daily logbook, which should be countersigned by the governmental agency representative and the teacher-mentor. The teacher-mentor is required to periodically visit the students and provide guidance.

III B.Tech I Sem (E.C.E)

23BTEC09T	ANALOG AND DIGITAL IC APPLICATIONS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the classification of Integrated Circuits, internal blocks, and characteristics of Op-Amp.
2. To analyze linear and non-linear applications of the Op-Amp.
3. To gain knowledge on active filters, timers, and phased locked loops.
4. To understand the working of Voltage Regulators and Converters.
5. To study different types of Digital ICs and their applications.

Course Outcomes:

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

1. Understand the classification of Integrated Circuits, internal blocks, and characteristics of Op-Amp.
2. Analyze linear and non-linear applications of Op-Amp.
3. Gain knowledge on active filters, timers, and phased locked loops.
4. Understand the working of Voltage Regulators and Converters.
5. Know about different types of Digital ICs and their applications.

UNIT-I ICs and OP-AMPS

Integrated Circuits and Operational Amplifier: Introduction, Classifications, IC chip size and circuit complexity, basic information of Op-Amp IC741 and its features, the ideal Operational amplifier, Op-Amp internal circuit, Op-Amp characteristics - DC and AC, Features of 741 Op-Amp.

UNIT-II Applications of OP-AMP

Linear Applications of Op-Amp: Inverting, non-inverting, Differential amplifiers, adder, subtractor, Instrumentation amplifier, AC amplifier, V to I and I to V converters, Integrator, and differentiator.

Non-Linear Applications of Op-Amp: Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multi vibrators, Triangular and Square waveform generators, Oscillators.

UNIT-III Active Filters and other ICs

Active Filters: Introduction, Butterworth filters – 1^{st} order, 2^{nd} order low pass and high pass filters, band pass, band reject, and all pass filters.

Timer and Phase Locked Loops: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL, and applications of PLL.

UNIT-IV Voltage Regulators and Converters

Voltage Regulator: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general-purpose regulators, Switching Regulator.

D to A and A to D Converters: Introduction, basic DAC techniques-weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters - parallel comparator type ADC, counter type ADC, successive approximation ADC, and dual slope ADC, DAC and ADC Specifications.

UNIT-V Digital ICs

CMOS Logic: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic.

Combinational Logic ICs: Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Parallel Binary Adder/ Subtractor, Magnitude Comparators.

Sequential Logic ICs: Familiarity with commonly available 74XX & CMOS40XX Series ICs - All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.

Textbooks:

1. D. Roy Choudhury, Shail B.Jain,―Linear Integrated Circuit‖, 4th edition (2012), NewAge International Pvt. Ltd., New Delhi, India
2. Floyd, Jain,―DigitalFundamentals‖, 8th edition (2009), Pearson Education, New Delhi.

References:

1. Ramakant A.Gayakwad,―OP-AMP and Linear Integrated Circuits‖, 4th edition (2012), Prentice Hall / Pearson Education, New Delhi.
2. Sergio Franco(1997), Design with operational amplifiers and analog integrated circuits, McGraw-Hill, New Delhi.
3. Gray, Meyer(1995), Analysis and Design of Analog Integrated Circuits, Wiley International, New Delhi.

III B. Tech I Sem (E.C.E)

23BTEC10T	**ANTENNAS & WAVE PROPAGATION**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To learn the antennas basic terminology, the radiation mechanism of antennas, and dipole antennas.
2. To gain knowledge on HF, VHF &UHF antennas, their operation, and applications.
3. Analyze the working and applications of Microwave antennas.
4. Understand different techniques involved in the design of antenna arrays and antenna parameter measurements.
5. To study the various types of radio wave propagation methods.

Course Outcomes:

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

1. Understand the antennas basic terminology and radiation mechanism of antennas.
2. Gain knowledge on VHF and UHF antennas, their operation, and applications.
3. Design and analyze the working and applications of Microwave antennas.
4. Analyzed different techniques involved in the design of antenna arrays and antenna parameter measurements.
5. Gain a comprehensive knowledge of the types of radio wave propagation methods.

UNIT-I

Antenna Basics & Dipole antennas: Definition of antenna, Radiation Mechanism –single wire, two wire, dipoles, Antenna Parameters - Radiation Patterns, Main Lobe and Side Lobes, Beam widths, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Aperture Efficiency, Effective Height and length, Antenna Theorems. Radiation – Basic Maxwell‘s equations, Retarded potential-Helmholtz Theorem, Radiation from Small Electric Dipole, Quarter wave Monopole and Half wave Dipole – Current Distributions, Field Components, Radiated power, Radiation Resistance, Beam width, Natural current distributions, far fields and patterns of Thin Linear Center-fed Antennas of different lengths, Illustrative problems.

UNIT-II

HF, VHF, and UHF Antennas: Loop Antennas - Introduction, Small Loop, Comparison of far fields of small loop and short dipole, Radiation Resistances and Directives of small and large loops (Qualitative Treatment), Arrays with Parasitic Elements - Yagi - Uda Arrays, Folded Dipoles & their characteristics. Log periodic Antenna, Helical Antennas-Helical Geometry, Helix modes, Practical Design considerations for Monofilar Helical Antenna in Axial and Normal Modes. Horn Antennas- Types, Fermat‘s Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.

UNIT-III

Microwave Antennas: Micro strip Antennas- Introduction, features, advantages and limitations, Rectangular patch antennas- Geometry and parameters, characteristics of Micro strip antennas, Impact of different parameter son characteristics, reflector antennas - Introduction, Flat sheet and corner reflectors, parabola reflectors- geometry, pattern characteristics, Feed Methods, Reflector Types-Related Features, Lens Antennas –Geometry of Non-metallic Dielectric Lenses, Zoning, Tolerances, Applications, Illustrative Problems.

UNIT-IV

Antenna Arrays: Point sources - Definition, Patterns, arrays of 2 Isotropic sources- Different cases, Principle of Pattern Multiplication, Uniform Linear Arrays – Broadside Arrays, Endfire Arrays, EFA with Increased Directivity, Derivation of their characteristics and comparison, BSAa with Non-uniform Amplitude Distributions - General considerations and Bionomial Arrays, Illustrative problems.

Antenna Measurements: Introduction, Sources of errors, Patterns to be Measured, Pattern Measurement Arrangement, Directivity Measurement, Gain Measurements (by comparison, Absolute and 3-Antenna Methods).

UNIT-V

Wave Propagation: Introduction, Definitions, Characterizations and general classifications, different modes of wave propagation, Ray/Mode concepts, Ground wave propagation (Qualitative treatment) - Introduction, Plane earth reflections, Space and surface waves, wavetilt, curved earth reflections, Space wave propagation - Introduction, field strength variation with distance and height, effect of earth‘s curvature, absorption, Super refraction, M-curves and duct propagation, scattering phenomena, tropospheric propagation, fading and path loss calculations, Sky wave propagation - Introduction, structure of Ionosphere, refraction and reflection of sky waves by Ionosphere, Ray path, Critical frequency, MUF, LUF, OF, Virtual height and Skip distance, Relation between MUF and Skip distance, Multi-HOP propagation, Energy loss in Ionosphere, Summary of Wave Characteristics in different frequency ranges, Illustrative problems.

TEXT BOOKS:

1. John D. Kraus, Ronald J. Marhefka, and Ahmad S.Khan,―Antennas and wave propagation‖, TMH, New Delhi, 4th Ed., 2010.
2. C.A. Balanis, ―Antenna Theory- Analysis and Design‖, John Wiley & Sons, 2nd Edn.,2001.
3. K.D. Prasad and Satya Prakashan, ―Antennas and Wave Propagation‖, New Delhi, Tech. India Publications, 2001.

REFERENCES:

1. E.C. Jordan and K.G. Balmain, ―ElectromagneticWavesandRadiatingSystems‖,2nd Edition, PHI, 2000.
2. G.S.N Raju, ―Antenna and Wave Propagation‖, Pearson EducationIndia,3rdEdition 2009.
3. RKShevgaonkar,‖ElectromagneticWaves‖.TataMcGraw-Hill,2006

III B. Tech I Sem (E.C.E)

23BTEC11T	**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. Togetfamiliarabout8086 interfacing.
4. To understand the fundamentals of the 8051Microcontroller.
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 conceptsof8086interfacing.
4. Learn the fundamentals ofthe8051Microcontroller.
5. Know the interfacing with the 8051Microcontroller.

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, and assembly language program development tools.

UNIT III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255programmable 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, 3rd Edition,1994.
2. KM Bhurchandi, AK 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 8051Microcontroller, 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 the 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 I:

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 II:

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 de coherence – 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 III:

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, Vision vs reality: what‘s working and what remains elusive, The role of quantum software in managing theoretical complexities

Unit IV:

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: De coherence and Error Correction, Real-World Importance and Future Potential

Unit V:

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, Ps I Quantum, Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization, Emerging careers in quantum: roles, skill sets, 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. Elean or 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***, One World 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. **Giuliano Benenti, Giulio Casati, Giuliano Strini**, ***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 Qi skit Tutorials
- Course ra – Quantum Mechanics and Quantum Computation by UC Berkeley
- Ed X –The Quantum Internet and Quantum Computers
- YouTube– Quantum Computing for the Determined by Michael Nielsen
- Qiskit Textbook –IBM Quantum

III B. Tech I Sem (E.C.E)

23BTEC12a	COMPUTER ARCHITECTURE & ORGANIZATION	L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn the design of various functional units of digital computers and the performance issues of computer systems.
2. To understand the basic processing unit and its 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 computers and performance issues of computer systems.
2. Understand the basic processing unit and its 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:

Microprogrammed Control: Control memory, Address sequencing, microprogram 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, and 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. Multiprocessors: Characteristics of Multiprocessors, Interconnection Structures, Inter-processor arbitration, Inter-processor communication and synchronization, Cache Coherence.

Textbook:

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

References:

1. Computer Organization–Car Hamacher, Zvonks Vranesic, Safea Zaky, Vth Edition, McGraw-Hill.
2. Computer Organization and Architecture–William Stallings, Sixth Edition, Pearson/PHI.
3. Structured Computer Organization–AndrewS.Tanenbaum,4th Edition, PHI/Pearson.

III B. Tech I Sem (E.C.E)

23BTEC12bT	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, Shannon-Fano Coding, Free fix code, Coding an information Source, Huffman Coding, Example.

Variable to Block Length Coding: Proper message set, assigning probabilities to a 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, Che by Shev inequality, Weak law of large numbers, Typical Sequences, Block to Block Coding of DMS: Consequences of Asymptotic Equi-partition 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, Goutam Saha, 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, JohnWiley,4th Edition,2010.

III B. Tech I Sem (E.C.E)

23BTEC12cT	**DETECTION AND ESTIMATION THEORY**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the impact of white Gaussian noise on the detection of signals.
2. To analyze the detection of deterministic signals and random signals.
3. To learn about the nonparametric detections.
4. To analyze the estimation signal parameter and apply suitable estimation techniques.
5. To understand the signal estimation in Discrete-Time techniques.

Course Outcomes:

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

1. Understand the impact of white Gaussian noise on the detection of signals.
2. Analyze the detection of deterministic signals and random signals.
3. Learn about them on parametric detections.
4. Analyze the estimation signal parameter and apply suitable estimation techniques.
5. Understand the signal estimation in Discrete-Time techniques.

UNIT 1

Statistical Decision Theory: Review of Gaussian variables and processes; problem formulation and objective of signal detection and signal parameter estimation in the discrete-time domain. Bayesian, mini max, and Neyman-Pearson decision rules, likelihood ratio, receiver operating characteristics, composite hypothesis testing, locally optimum tests, detector comparison techniques, and asymptotic relative efficiency.

UNIT 2

Detection of Deterministic Signals: Matched filter detector and its performance; generalized matched filter; detection of sinusoid with unknown amplitude, phase, frequency arrival time, linear model.

Detection of Random Signals: Estimator-correlator, linear model, general Gaussian detection, detection of a Gaussian random signal with unknown parameters, weak signal detection

UNIT 3

Nonparametric Detection: Detection in the absence of a complete statistical description of observations, sign detector, Wilcoxon detector, detectors based on quantized observations, and robustness of detectors.

UNIT 4

Estimation of Signal Parameters: Minimum variance unbiased estimation, Fisher information matrix, Cramer-Rao bound, sufficient statistics, minimum statistics, complete statistics; linear models; best linear unbiased estimation; maximum likelihood estimation, invariance principle; estimation efficiency; Bayesian estimation: philosophy, nuisance parameters, risk functions, minimum mean square error estimation, maximum a posteriori estimation.

UNIT 5

Signal Estimation in Discrete-Time: Linear Bayesian estimation, Weiner filtering, dynamical signal model, discrete Kalman filtering.

Textbooks:

1. H. L. Van Trees, "Detection, Estimation and Modulation Theory: Part I, II, and III", John Wiley, NY, 1968.
2. H.V.Poor, "An Introduction to Signal Detection and Estimation", Springer, 2/e,1998.

Reference books:

1. S. M. Kay, "Fundamentals of Statistical Signal Processing: Estimation Theory", Prentice Hall PTR, 1993.
2. S. M. Kay, "Fundamentals of Statistical Signal Processing: Detection Theory", Prentice Hall PTR, 1998.

III B.Tech I Sem (E.C.E)

		L	T	P	C
23BTEC06P	**ANALOG &DIGITAL IC APPLICATIONS LAB**	0	0	3	1.5

Course Objectives:

1. To design an Inverting and Non-inverting Amplifier using an Op Amp.
2. To demonstrate the Linear and Non-Linear Applications using IC741.
3. To design A stable and Monostable Multi vibrator using timer ICs.
4. To analyze the DAC and ADC converters.
5. To design Counters and Registers using digital ICs.

Course Outcomes:

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

1. Design an Inverting and Non-inverting Amplifier using an Op Amp.
2. Demonstrate the Linear and Non-Linear Applications using IC741.
3. Design A stable and Mono stable Multi vibrator using timer ICs.
4. Analyze the DAC and ADC converter.
5. Design Counters and Registers using digital ICs.

List of Experiments: (**At least 8 Linear and 4 Digital IC experiments shall be performed**).

1. Design an Inverting and Non-inverting Amplifier using an Op Amp and calculate the gain.
2. Design an Adder and Subtractor using an Op Amp and verify the addition and subtraction processes.
3. Design a Comparator using an Op Amp and draw the comparison results of A=B, A>B, and A<B.
4. Design an Integrator and Differentiator Circuits using IC741 and derive the required condition practically.
5. Design an Active LPF, HPF cutoff frequency of 2KHZ, and find the roll off of it.
6. Design a Circuit using IC741 to generate a sine/square/triangular wave with a period of 1KHz and draw the output waveform.
7. Construct a Monostable Multi vibrator using IC555 and draw its output waveform.
8. Construct A stable Multi vibrator using IC555 and draw its output waveform, and also find its duty cycle.
9. Design a Schmitt Trigger Circuit and find its LTP and UTP.
10. Design a Voltage Regulator using IC723, IC 7805/7809/7912, and find its load regulation factor.
11. Design a 2R ladder DAC and find its resolution, and write a truth table with respective voltages.
12. Design a Parallel comparator type/ counter type/ successive approximation ADC and find its efficiency.
13. Design a8x1multiplexer using digital ICs.
14. Design a 4-bit adder/subtractor using digital ICs
15. Design a Decade counter and verify its truth table, and draw the respective waveforms.
16. Design an up/down counter using IC74163 and draw read/write waveforms.
17. Design a Universal shift register using IC 74194/195andverify its shifting operation.
18. Design an 8x3 encoder/3x8 decoder and verify its truth table.

III B.Tech I Sem (E.C.E)

23BTEC07P	**MICROPROCESSORS AND MICROCONTROLLERS LAB**	**L**	**T**	**P**	**C**
		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 the 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 for16 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 the 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 the Addition/ subtraction of N no _s.
   b) Write an ALP for finding the largest/smallest no.
   c) Write an ALP to sort the given array in ascending/descending order.

4. **Programs on String Manipulations for 8086**
   a) Write an ALP to find the 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 a String and check for a palindrome.

5. Programs for Digital Clock Design Using 8086

a) Write an ALP for designing a clock using INT 21H Interrupt.
b) Write an ALP for designing a clock using DOS Interrupt Functions.
c) Write an ALP for designing a clock by reading the system time.

6. InterfacingStepperMotorwith8086

a) Write an ALP to the 8086 processor to interface a stepper motor and operate it in a clockwise direction by choosing a variable step size.
b) Write an ALP to the 8086 processor to interface a stepper motor and operate it in an Anti-clockwise direction by choosing a variable step size.

7. Interfacing ADC/DAC with 8086

a) Write an ALP to the 8086 processor to Interface ADC.
b) Write an ALP to the 8086 processor to interface the DAC and generate a Square Wave/Triangular Wave,/Step signal.

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. ProgramsusingArithmeticandLogicalInstructionsfor8051

a) Write an ALP to8051Microcontroller to perform Arithmetic operations like addition, subtraction,
b) Multiplication and Division.
c) Write an ALPto8051Microcontroller 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 interface a 16*2 LCD to the 8051.
b) Develop and execute the program to interface the LCD to805 1in 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. Krayand K.M.Bhurchandani, TMH, 2ndedition2006.

The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi, Janice Gillispie Mazidi, Second Edition.

III B. Tech I Sem (E.C.E)

23BTEC08P	**PCB DESIGN AND PROTOTYPE DEVELOPMENT**	**L**	**T**	**P**	**C**
	(SEC – III)	0	1	2	2

Course Objectives:

1. Identifying Electronic Components Symbols &Footprints.
2. To analyze the capability to produce PCBs soft their circuit.
3. To effectively use the design rules &interfacing between the 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 a PCB layout of their design.
3. Detailed description and practical of PCB designing.

UNIT I:

Fundamentals of basic electronics: Component identification, Component symbols & their footprints, understanding 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
   - Schematic Design: Familiarization withthe Schematic Editor, Schematic creation, Annotation, Net list generation.
   - Layout Design: Familiarization with Footprint Editor, Mapping of components, Creation of PCB layout Schematic.
   - Create new schematic components.
   - Create new component footprints.

2. Regulator circuit using 7805
3. Inverting Amplifier or Summing Amplifier using op-amp
4. Full-wave Rectifier
5. A stable multi vibrator using IC555
6. Mono stable multi vibrator using IC555
7. RC Phase-shifter oscillator using a transistor.
8. Wein-bridge Oscillator using 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) experiment of a similar nature and magnitude to the above is to be assigned by the teacher.

    (Student is expected to solve and execute/simulate independently).
12. Design an 8051 Development board having a Power section consisting of an IC7805, a capacitor, a resistor, headers, LED.
13. Design an 8051 Development board having a Serial communication section consisting of MAX232, Capacitors, a DB9 connector, a Jumper, and LEDs.
14. Design an 8051 Development board having Reset & Input/output sections consisting of 89C51Microcontroller, Electrolytic Capacitor, Resistor, Jumper, Crystal Oscillator, and Capacitors.
15. Fabricate a single-sided PCB, mount the components, and assemble them in a cabinet for any one of the circuits mentioned in the above exercises.

References:

1. JonVarteresian, FabricatingPrintedCircuitBoards,z,2002
2. R.Tummala, Fundamentals of Microsystems Packaging, McGraw-Hill, 2001.
3. C.Robertson.PCBDesigner´sReference.Prentice Hall,2003
4. Open-source EDA Tool Ki Cad Tutorial: http://kicad-pcb.org/help/tutorials/ 13. PCB Fabrication user guide page:

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

   Boardshttp://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

23BTEC09P	**TINKERING LAB**	**L**	**T**	**P**	**C**
		2	0	0	1

The aim of the 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 mindset

These labs bridge the gap between academia and industry, providing students with 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 mindset to experiment, innovate, and solve real-world challenges.

List of experiments:

1) Make your own parallel and series circuits using a 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 Dust Bin 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) Fire-fighting 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 (E.C.E)

		L	T	P	C
23BTEC15T	**DIGITAL SIGNAL PROCESSING**	3	0	0	3

Course Objectives:

1. To get familiar with the properties of discrete-time signals, systems, and z-transforms.
2. To learn the importance of the FFT algorithm for the computation of the Discrete Fourier Transform and Fast Fourier Transform with decimations.
3. To understand the implementations of digital filter structures.
4. To analyze the FIR filter design using the Fourier series and windowing methods.
5. To gain 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 the FFT algorithm for the computation of the Discrete Fourier Transform and Fast Fourier Transform with decimations.
3. Understand the implementations of digital filter structures.
4. Analyze the FIR filter design using the Fourier series and windowing methods.
5. Gain 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, TATAM c- Graw Hill, 2007.
3. Robert J. Schilling, Sandra L. Harris, Fundamentals of Digital Signal Processing using Matlab, Thomson, 2007.

III B. Tech II Semester (E.C.E)

		L	T	P	C
23BTEC16T	**MICROWAVE AND OPTICAL COMMUNICATION**	3	0	0	3

Course Objectives:

- To analyze different modes of operation in rectangular waveguides, circular waveguides, and resonators.
- To study and analyze various microwave components and microwave sources.
- To gain knowledge on different microwave semiconductor devices and microwave measurement procedures.
- To analyze 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

- Analyze different modes of operation in rectangular waveguides, circular waveguides, and resonators.
- Understand and analyze various microwave components and microwave sources.
- Gain knowledge on different microwave semiconductor devices and microwave measurement procedures.
- Analyze different optical fiber modes and study different types of distortions and losses in optical communication.
- Understand and study various optical sources, optical detectors, and analyze 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, and 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. ReichH.J.,etal,―MicrowavePrinciples‖, MIT Press,1972.
4. FETerman,―Electronic and Radio Engineering‖, Mc Graw Hill,4thEdition,1984

III B. Tech II Semester (E.C.E)

23BTEC17T	**VLSI DESIGN**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To understand the steps involved in the fabrication of ICs using MOS transistor technology.
2. To learn about the VLSI design processes, Stick diagrams, and Layouts.
3. To gain knowledge of 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 the fabrication of ICs using MOS transistor technology.
2. Learn about the VLSI 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 & Bi CMOS Technologies. Basic Electrical Properties of MOS and Bi-CMOS 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 guidelines – scan design techniques.

Textbooks:

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

References:

1. CMOS VLSI Design Circuits and Systems Perspective, Neil H.E. Weste, David Harris, Ayan Banerjee, 3rd Edn, Pearson, 2009.
2. BehzadRazavi,―DesignofAnalogCMOSIntegratedCircuits‖, McGraw-Hill,2003.
3. JanM.Rabaey,―DigitalIntegratedCircuits‖, Anantha Chandrakasan and Borivoje Nikolic, Prentice-Hall of India Pvt.Ltd, 2nd edition, 2009.

III B. Tech II Semester (E.C.E)

23BTEC18aT	**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To know about the performance characteristics of instruments and the 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 the 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-multi range, range extension/solid state and differential voltmeters, AC voltmeters–multi range, range extension. Thermo couple type RF ammeter, ohmmeters, series type, shunt type, multi-meter for voltage, current, and resistance measurements.

UNIT-II

Oscilloscopes: Introduction, Basic Principle, Standard specifications of CRO, CRT features, verticalandhorizontalamplifiers,horizontalandverticaldeflectionsystems,sweeptriggerpulse, 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: Wheatstone bridge, Kelvin‘s Bridge, AC Bridges for Measurement of inductance- Maxwell‘s bridge, Hay‘s Bridge, Anderson bridge. Measurement of capacitance- Schering 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,―ElectronicInstrumentation‖,2nd edition, Tata McGraw-Hill,2004.

REFERENCES:

1. DavidA.Bell,―ElectronicInstrumentation&Measurements‖,2nd Edition, PHI,2003.
2. K.LalKishore,―ElectronicMeasurements&Instrumentations‖, Pearson Education, 2009.

III B. Tech II Semester (E.C.E)

		L	T	P	C
23BTEC18bT	**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 the 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 IoT standards, communication technologies, and protocols for IoT devices.
5. Implement case studies and applications using the tools and techniques of the 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 to 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, RESTful 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; Device 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,VijayMadisetti,―InternetofThings:AHands-OnApproach‖,1st Edition, VPT, 2014.
2. K.V.K.K.Prasad, ―Embedded Real Time Systems: Concepts, Design and Programming‖, 1st Edition, Dreamtech Publication, 2014.
3. AdrianMcEwen,HakimCassimally,―DesigningtheInternetofThings‖,WileyPublications, 2013

REFERENCES

1. JonathanWValvano,―Embedded Microcomputer Systems: Real-TimeInterfacing‖,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. ReneBeuchat, Andrea Guerrieri & Sahand Kashani―Fundamentals of System-on-Chip Design on Arm Cortex-M Microcontrollers ‖ Paperback, 2 August 2021.

III B. Tech II Semester (E.C.E)

		L	T	P	C
23BTEC18cT	**SPEECH PROCESSING**	3	0	0	3

Course Objectives:

1. To impart knowledge on the anatomy and physiology of speech organs and the process of Speech Production.
2. To understand the methods for extracting speech using Time domain parameters.
3. To learn the Frequency Domain Methods for Speech Processing.
4. To interpret and analyze LPC Parameters for Speech Processing.
5. To introduce the concepts of homomorphic Speech Processing.

Course Outcomes:

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

1. Gain knowledge on the anatomy and physiology of speech organs and the process of Speech Production.
2. Understand the methods for extracting speech using Time domain parameters.
3. Learn the Frequency Domain Methods for Speech Processing.
4. Interpret and analyze LPC Parameters for Speech Processing.
5. Grasp the concepts of homomorphic Speech Processing.

UNIT I:

Fundamentals of Digital Speech Processing: Anatomy & Physiology of Speech Organs, The process of Speech Production, The Acoustic Theory of Speech Production – Uniform lossless tube model, effect of losses in vocal tract and radiation at lips, Digital models for speech signals.

UNIT II:

Time Domain Methods for Speech Processing: Time domain parameters of speech, methods for extracting the parameters: Zero crossings, Auto-correlation function, pitch estimation.

UNIT III:

Frequency Domain Methods for Speech Processing: Short-time Fourier analysis, Filter bank analysis, Spectrographic analysis, Formant extraction, Pitch extraction.

UNIT IV:

Linear predictive Coding (LPC) for Speech: Formulation of the linear prediction problem in the time domain, solution of normal equations, Interpretation of linear prediction in autocorrelation and

Spectral domains, Method of Solution of the LPC Parameters: Pitch Detection using LPC Parameters, Formant Analysis using LPC Parameters.

UNIT V:

Homomorphic Speech Processing: Introduction Homomorphic Systems for Convolution: Properties of the Complex Cepstrum, Computational Considerations, The Complex Cepstrum of Speech, pitch Detection and Formant Estimation; Applications of speech processing – Speech Enhancement, Speech recognition, Speech synthesis and Speaker Verification.

Textbooks:

1. L.R.Rabinerand S.W.Schafer, Digital Processing of Speech Signals, Pearson Education.
2. Douglas O Shaughnessy, Speech Communications: Human &Machine,2nd Ed., Wiley-IEEE Press.

References:

1. Thomas F. Quatieri, Discrete Time Speech Signal Processing: Principles and Practice, 1st Ed., Pearson Education.
2. Ben Gold& Nelson Morgan, Speech and Audio Signal Processing: Processing and Perception of Speech and Music,1st Ed., Wiley.

III B. Tech II Semester (E.C.E)

23BTEC19aT	**DIGITAL IMAGE PROCESSING**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To learn the fundamentals of Image Processing with different Transforms.
2. To understand the functions of Intensity Transformations and the working fundamentals of Spatial Filters
3. To implement various models of Restoring and Reconstruction of Images from filtering projections.
4. To study the concepts of image compression using different coding &Wavelets, and multi-resolution 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. Understand the functions of Intensity Transformations and the working fundamentals of Spatial Filters.
3. Implement various models of Restoring and Reconstruction of Images from filtering projections.
4. Grasp the concepts of image compression using different coding & Wavelets, and multi-resolution 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, and 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 Multi resolution Processing: Image pyramids, sub band coding, Multi resolution 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, and color image compression.

Textbooks:

1. R.C. Gonzalezand R.E.Woods, Digital Image Processing,3rd edition, Prentice Hall, 2008.
2. Jayaraman, S. Esakkirajan, and T.Veerakumar,‖DigitalImageProcessing‖, 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.Dutta Majumder,―Digital Image Processing and Analysis‖, PHI, 2009

Online Learning Resources:

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

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

III B. Tech II Semester (E.C.E)

23BTEC19bT	**ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

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

Course Outcomes:

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

1. To learn the basics and problems of Artificial Intelligence with the 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 the Shopping World.
4. To understand the concepts of Machine Learning from different Perspectives.
5. To analyze the 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) SarojKaushik,―ArtificialIntelligence‖,CengageLearningIndia,2011
2) ElaineRichandKevinKnight,―ArtificialIntelligence‖,TataMcGrawHill
3) David Poole and Alan Mackworth, ―Artificial Intelligence: Foundations for Computational Agents‖, Cambridge University Press, 2010.
4) Trivedi, M.C., A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi.
5) Christopher Bishop, Pattern Recognition and Machine Learning (PRML), Springer, 2007.
6) Shai Shalev-Shwartz and Shai Ben-David, Understanding Machine Learning: From Theory to Algorithms(UML), Cambridge University Press, 2014.

III B. Tech II Semester (E.C.E)

23BTEC19cT	SATELLITE COMMUNICATIONS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To learn the principles of orbital mechanics & satellite launch systems with performance parameters.
2. To describe the elements of the communication satellite design format, ching reliability.
3. To know the working concepts of various multiple access techniques and Onboard processing.
4. To analyze the satellite ink design with communication links.
5. To evaluate the working of the 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 systems with performance parameters.
2. Describe the elements of communication satellite design format ching reliability.
3. Gain knowledge on various multiple access techniques and on-board processing.
4. Analyze the satellite links design with communication links.
5. Evaluate the working of the 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:

D.Roddy, Satellite Communication (4/e), McGraw-Hill,2009.

T.Pratt &C.W. Bostain, Satellite Communication, Wiley, 2000.

References:

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

III B. Tech II Semester (E.C.E)

23BTEC11P	**MICROWAVE AND OPTICAL COMMUNICATIONS LAB**	**L**	**T**	**P**	**C**
		0	0	3	1.5

Course Objectives:

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

Course Outcomes:

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

1. Understand the working of the microwave bench setup and the characteristics of microwave sources.
2. Verify the characteristics of various microwave components and draw the radiation pattern of antennas.
3. Verify the characteristics of optical sources & detectors and study 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 the Directional Coupler
9. Scattering Parameters of Magic TEE
10. Radiation pattern measurement of an Antenna
11. Antenna gain measurement

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

1. Characterization of LED
2. Characterization of Laser Diode
3. Intensity Modulation of Laser output through Optical fiber
4. Measurement of data rate for a digital Optical link
5. Measurement of Numerical Aperture.
6. Measurement of Losses for an Analog Optical Link

III B. Tech II Semester (E.C.E)

23BTEC12P	VLSI DESIGN LAB	L	T	P	C
		0	0	3	1.5

Course Outcomes:

1. To design a logic circuit using CMOS transistors using 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 designs for analysis.
4. To design different layouts using different Software tools for analog circuits.

Course Objectives:

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

1. Design a logic circuit using CMOS transistors using 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 designs for analysis.
4. Design different layouts using different software tools for analog circuits.

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

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

2. **Design and analysis of NAND and NOR Logic gates**
   a) Implement a NAND/NOR schematic using 180nm technology and design its symbol.
   b) Implement a 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 a parametric sweep.

3. **Design and analysis of XOR and XNOR Logic gates**
   a) Implement an XOR/XNOR schematic using 180 nm technology and design its symbol.
   b) Implement a 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 a parametric sweep.

4. **Design of AOI logic**
   a) Design a Schematic for AB + C _D and check its output response.
   b) Design a Schematic for AB_+C_ D and check its output response.
   c) Design a Schematic for(A+B_)(C+D)and check its output response.
   d) Design a Schematic for(A+B_)(C_+D)and check its output response.

5. Design and analysis of a Full adder
a) Design a full adder using Full custom IC design.
b) Design a full adder using semi-custom IC design.

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

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

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

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

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

11. Design of Inverter Layout
a) Design and implement an inverter schematic.
b) Design the layout for the inverter using the 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 a NAND/NOR schematic.
b) Design the inverter using the 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. A personal computer system with the necessary software to run the programs and implement them.

III B. Tech II Semester (E.C.E)

		L	**T**	**P**	**C**
23BTEC13P	**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 the 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 the k-Nearest Neighbor algorithm to classify there is 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)

Implement the following concepts using Python with supporting applications.

1. Familiarizing with Anaconda and Jupyter for importing modules and dependencies for ML. Familiarization with NumPy, Pandas, and Matplotlib by Loading a 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 the diabetes dataset using Logistic regression
    b) Implement the speech-to-text model(NLP-Speech recognition system)from a speech dataset using the concept of linear regression
4. **Polynomial regression***:*
    a. Determine the quality of wine using the wine dataset with the help of polynomial regression
    b. Implement the speech recognition model (NLP) from a speech / audio data set using the concept of polynomial regression.

5. **K-means clustering***:* Apply the concept of K-means clustering for the image segmentation problem (Brain tumor and Lung images)/Color quantization.
6. Write a program to implement the 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 a Face recognition system
9. Design an Artificial neural network for Digit classification using the Back Propagation Algorithm for the MNIST dataset. Train MLP using the Gradient descent algorithm by applying Linear, Sigmoid, tanh, and ReLU activation functions.
10. **Digit recognition using CNN:** Identify the digits0-9 from MNIST data and CIFAR-10 set using CNN
11. Image Classification using CNN: Classify cats and dogs using CNN from the given dataset
12. LSTM (Long Short-Term Memory Networks)/ARIMA--- Implementation of 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) Saw tooth

2. Generate the 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 an IIR Butterworth filter and compare its performance with different orders(Low Pass Filter /High Pass Filter)
9. Design an IIR Chebyshev filter and compare its performance with different orders(LowPass Filter /High Pass Filter).
10. Design an FIR filter(Low Pass Filter/High Pass Filter)using the windowing technique.

i. Using a rectangular window, ii. Using a Hamming window, iii. Using the Kaiser window

11. Design and verify the Filter (IIR and FIR)frequency response by using the 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. Sivanandam and S.N.Deepa, Introduction to Neural Networks Using MATLAB,2006.
2. Simon Haykin, Neural Networks and Learning Machines, PHI, 3rd, Edition 2008.
3. Digital Signal Processing: Alon V.Oppenhelm, PHI
4. Digital Signal processing(II-Edition):S.K.Mitra,TMH

III B. Tech II Semester (E.C.E)

23BTEC21T	**TECHNICAL PAPER WRITING AND INTELLECTUAL PROPERTY RIGHTS**	**L**	**T**	**P**	**C**
		0	1	2	2

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 a quality literature review
4. To help them know the significance of real-life practice and procedure of Patents.
5. To enable them to 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 paper 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	Analyze the rights and responsibilities of the holder of a Patent, Copyright, trademark, International Trademark, etc.	L4
CO5	Evaluate different forms of IPR available at the national & international level	L5
CO6	Develop the skill of searching for various forms of IPR by using Modern tools and techniques.	L3,L6

SYLLABUS

UNIT – I:

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence, and logical 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- Problems and Framing Research Questions- Synopsis

UNIT – III:

Process of research: publication mechanism: types of journals- indexing-seminars, conferences, proofreading, plagiarism style; seminar & conference paper writing; Methodology-discussion-results- citation rules

UNIT– IV:

Introduction 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 trademark rights, protectable matter, selecting and evaluating trademarks, and trademark registration processes.

UNIT – V:

Law of copyrights: Fundamentals of copyright law, originality of material, rights of reproduction, rights to perform the work publicly, copyright ownership issues, copyright registration, notice of copyright, international copyright 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, Asialaw 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 Wall's work. *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**

IV B. Tech I Sem (E.C.E)

		L	T	P	C
23BTEC22T	**DATA COMMUNICATIONS AND NETWORKING**	3	0	0	3

Course Objectives:

1. To provide a conceptual understanding of the fundamentals of data communications and computer networks.
2. To explore different network architectures, models, and transmission media used in data communication.
3. To analyze error detection and correction methods, data link protocols, and medium access techniques.
4. To understand the functioning of network and transport layer protocols, including addressing, routing, and congestion control.
5. To study application layer protocols, network security mechanisms, and techniques to ensure data integrity.

Course Outcomes:

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

1. Understanding of the fundamentals of data communications and computer networks.
2. Learn different network architectures, models, and transmission media used in data communication.
3. Analyze error detection and correction methods, data link protocols, and medium access techniques.
4. Grasp the functioning of network and transport layer protocols, including addressing, routing, and congestion control.
5. Gain knowledge on application layer protocols, network security mechanisms, and techniques to ensure data integrity.

UNIT-I:

Overview of Data Communication and Networking: Introduction; Data communications: components, direction of data flow; network criteria, physical structure, categories of network (LAN, MAN, WAN); Internet: brief history, Protocols and standards; Reference models: OSI reference model, TCP/IP reference model, their comparative study.

UNIT-II:

Physical Layer: Overview of data (analog & digital), signal (analog& digital), transmission (analog & digital) & transmission media (guided & unguided), queuing theory, its applications in data communication, Data Encoding Techniques, Circuit switching, time division & space division switching.

UNIT-III:

Data Link Layer: Types of errors, framing (character and bit stuffing), error detection & correction methods; Flow control; Protocols: Stop & wait ARQ, Go-Back-N- N ARQ, Selective repeat ARQ, HDLC

Medium Access sub layer: Point to Point Protocol, Token Ring; Reservation, Polling, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA, Traditional Ethernet, Fast Ethernet.

UNIT-IV:

Network layer: Internetworking & devices: Repeaters, Hubs, Bridges, Switches, Router, Gateway; Addressing: IP addressing, subnetting; Routing: techniques, static vs. Dynamic routing, Unicast Routing Protocols: RIP, OSPF, BGP; Other Protocols: ARP, IP, ICMP, IPV6

Transport layer: Process-to-Process delivery; UDP; TCP; Congestion Control: Open Loop, Closed Loop choke packets; Quality of service: techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm.

UNIT-V:

Application Layer: Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography (Public, Private Key-based), Digital Signature, Firewalls.

Textbooks:

1. B.A.Forouzan–—Data Communications and Networking (3rdEd.)—–TMH
2. A.S.Tanenbaum–—Computer Networks (4th Ed.)‖–Pearson Education/PHI

Reference Books:

1. W.Stallings–—Data and Computer Communications (5thEd.)‖–PHI/Pearson Education
2. KuroseandRose–—ComputerNetworking-Atopdownapproachfeaturingtheinternet‖ – Pearson Education
3. Leon, Garcia, Widjaja–—Communication Networks‖–TMH

IV B. Tech I Sem (E.C.E)

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

Syllabus

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 their earning of loyalty and ethical Behavior
- Explain various types of Ethics
- Analyze issues & crises 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 FRAMEWORK

Law and Ethics -Agencies enforcing Ethical Business Behavior - Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and well-being 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 framework, Corporate scams -Committees in India and abroad, corporate social responsibility. Bo Ds composition, Cadbury Committee - Various committees- Reports - Benefits and Limitations.

LEARNING OUTCOMES:-After completion of this unit student will
- Understand the corporate governance code
- Analyze the role of auditors, the board of directors, and shareholders in corporate governance
- Implementing corporate social responsibility in India.

Textbooks.

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

2. Bholananth Dutta, S.K. Podder–Corporation Governance, VBH.June2010

Referencebooks

1. Dr.K. Nirmala, Karunakara Readdy. *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/

IV B. Tech I Sem (E.C.E)

		L	T	P	C
23A52701b	**E-Business Management Course-II**	2	0	0	2

Course Objectives: The Objectives of this course are	
1	To provide knowledge on emerging concepts in E-Business-related aspects.
2	To understand various electronic markets &business models.
3	To impart the information about electronic payment systems & banking.
4	To create awareness of security risks and challenges in E-commerce.
5	To the students aware of different 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- 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 the opportunities of E-commerce for the 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 the Vertical portal and the Horizontal portals
- Analyze the B2B,B2C andB2G model

Unit-III:
Electronic Payment Systems:

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and cryptocurrencies –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 cards 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 networks
- 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 (e CRM) 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 KBajaj.*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,* Raymond Leatham, Wiley India, 2007
4. S.Jaiswal .*E-Commerce* Galgotia Publication Pvt Ltd., 2003.

COURSE OUTCOMES: At the end of the course, students will be able to		**BTL**
CO1	Remember E-Business &its nature, scope, and functions.	L1
CO2	Understand E-market models that are practiced 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 the 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-modelshttps://www.slideshare.net/RiteshGoyal/electronic-payment-systemhttps://www.slideshare.net/WelingkarDLP/electronic-securityhttps://www.slideshare.net/Ankitha2404/emarketing-ppt

IV B. Tech I Sem (E.C.E)

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 to have an idea of Recruitment, Selection, Training & Development, job evaluation, and Merit rating concepts
4	To create awareness on identifying Strategic Management areas & the PERT/CPM for better Project Management
5	To make the students aware of the contemporary issues in modern management

UNIT-I :

INTRODUCTION 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 of the Unit, the students will be able to

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

UNIT-IV:

STRATEGIC& PROJECTMANAGEMENT

Definition& Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - EnvironmentalScanning-StepsinStrategyFormulationandImplementation -SWOTAnalysis- **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- Re- engineering and Benchmarking - Knowledge Management – change management – sustainability and corporate social responsibility.

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

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

Text Books:

1. FrederickS.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. ThomasN.Duening&JohnM.Ivancevich, *Management Principles and Guidelines*, Biztantra.
4. Kanishka Bedi, Production and Operations Management, Oxford University Press,2004.
5. SamuelC.Certo, *ModernManagement*, 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 an 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 the project& to analyze the business through SWOT.	**L5**
CO6	Create awareness on contemporary issues in modern management & technology.	**L3**

BTL=BloomTaxonomy Level

ONLINE RESOURCES:

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/

IV B.Tech I Sem (E.C.E)

23BTEC23aT	**RADAR ENGINEERING**	**L**	**T**	**P**	**C**
		2	0	0	2

Course Objectives:

1. To understand the basic working principle of Radar and the target detection procedure.
2. To learn about the working and applications of CW and frequency-modulated Radar.
3. To comprehend the working and applications of MTI and Pulse Doppler Radar
4. To understand different methods of tracking a target and their limitations.
5. To analyze the effect of noise at the receiver and the uses of phased array antennas and navigational aids.

Course Outcomes:

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

1. Learn the basic working principle of Radar and the target detection procedure.
2. Know the working and applications of CW and frequency-modulated Radar.
3. Gain knowledge about MTI and Pulse Doppler Radar.
4. Understand different methods of tracking a target and their limitations.
5. Analyze the effect of noise at the receiver and the uses of phased array antennas and navigational aids.

UNIT-I

Basics of Radar: Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications, Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems. Radar Equation**:** SNR, Envelope Detector, False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Display types, Illustrative Problems.

UNIT-II

CW and Frequency Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar, Illustrative Problems.FM-CW Radar, Range and Doppler Measurement, Block Diagram and Characteristics (Approaching/ Receding Targets), FM-CW altimeter, Multiple Frequency CW Radar.

UNIT-III

MTI and Pulse Doppler Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, And Staggered PRFs. Range Gated Doppler Filters, MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler radar.

UNIT-IV

Tracking Radar: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar – Amplitude Comparison Monopulse (one- and two-coordinates), Phase Comparison Monopulse, Tracking in Range, Acquisition and Scanning Patterns, Comparison of Trackers.

UNIT-V

Detection of Radar Signals in Noise: Introduction, Noise Figure and Noise Temperature, Matched Filter Receiver – Response Characteristics and Derivation, Correlation detection, Detection criteria, Detector Characteristics, Automatic Detection, Constant False Alarm Rate Receiver. Introduction to Software Defined Radio, Introduction to Stealth Technology.

Radar Receivers: Introduction to Phased Array Antennas- Basic Concepts, Electronically Steered Phased Array Antennas, Phase Shifters, Frequency – scan Arrays, Radiation for Phased Array, Architecture for Phased Arrays. Radiation Pattern. Beam Steering and Beam Width changes. Navigational Aids: Direction Finder, VOR, ILS, and Loran.

TEXT BOOKS:

1. Merrill I.Skolnik,―Introduction to Radar Systems‖, 2nd Edition, TMH Special Indian Edition, 2007.
2. ByronEdde,―Radar Principals, Technology, Applications‖, Pearson Education,1992.

REFERENCES:

1. Peebles,―RadarPrinciples‖, Wiley, New York, 1998.
2. G.S.N.Raju,―Radar Engineering and Fundamentals of Navigational Aids‖, I.K. International Pvt. Ltd.
3. G.Sasi Bhushan Rao,―Microwave and Radar Engineering ‖,Pearson Education,2014

IV B.Tech I Semester (E.C.E)

23BTEC23bT	**DSP PROCESSORS & ARCHITECTURES**	**L**	**T**	**P**	**C**
		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, and 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, and A CODEC-DSP interface example.

TEXT BOOKS:

1. Avtar Singh and S. Srinivasan, ―Digital Signal Processing Implementation‖, 1st Edition, Cengage Learning, 2004.
2. Lapsleyetal.S.ChandandCo,―DSP Processor Fundamentals, Architectures& Features‖, 2000.

REFERENCES:

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

IV B. Tech I Sem (E.C.E)

23BTEC23cT	**CELLULAR & MOBILE COMMUNICATIONS**	**L**	**T**	**P**	**C**
	Professional Electives	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 Systems, 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/Ifromanormal case in an omnidirectional Antenna system, Cell splitting, consideration of the components of the 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, and 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 ‖,TataMc-GrawHill,2nd Edition,2006.
2. Theodore.S.Rapport,―Wireless communications‖,PearsonEducation,2nd Edn.,2002.

REFERENCES:

1. GordonL.Stuber,―Principles of Mobile communications‖,Springer International2nd Edition, 2007.
2. Lee,―Wireless and Mobile Communications‖,McGrawHills,3rd Edition,2006.
3. JonW.Mark and Weihua Zhqung,―Wireless Communications and Networking‖, PHI,2005.
4. R.Blake,―Wireless Communication Technology‖, Thompson Asia Pvt.Ltd.,2004.

IV B.Tech I Sem (E.C.E)

23BTEC24aT	**LOW POWER VLSI DESIGN**	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the need for low-power circuit design and analyze different power dissipation mechanisms in VLSI circuits.
2. To explore various low-power design approaches at the system, circuit, and mask levels.
3. To study low-power adder architectures and their role in power-efficient computing.
4. To examine different low-power multiplier architectures and their impact on digital design.
5. To gain knowledge of low-power memory technologies and their future developments.

Course Outcomes:

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

1. Understand the need for low-power circuit design and analyze different power dissipation mechanisms in VLSI circuits.
2. Learn various low-power design approaches at the system, circuit, and mask levels.
3. Gain knowledge on low-power adder architectures and their role in power-efficient computing.
4. Examine different low-power multiplier architectures and their impact on digital design.
5. Grasp knowledge of low-power memory technologies and their future developments.

UNIT-I

Fundamentals: Need for Low Power Circuit Design, Sources of Power Dissipation – Static and Dynamic Power Dissipation, Short Circuit Power Dissipation, Glitching Power Dissipation, Short Channel Effects –Drain Induced Barrier Lowering and Punch Through, Surface Scattering, Velocity Saturation, Impact Ionization, Hot Electron Effect.

UNIT-II

Low-Power Design Approaches: Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, Mask Level Measures.

UNIT-III

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

Save Adders, Low-Voltage Low-Power Design Techniques – Trends of Technology and Power Supply Voltage, Low-Voltage Low-Power Logic Styles.

UNIT-IV

Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures, Braun Multiplier, Baugh Wooley Multiplier, Booth Multiplier, Introduction to Wallace Tree Multiplier.

UNIT-V

Low-Voltage Low-Power Memories: Basics of ROM, Low-Power ROM Technology, Future Trend and Development of ROMs, Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

Textbooks:

1. CMOS Digital Integrated Circuits–Analysis and Design–Sung-MoKang, Yusuf Leblebici, TMH, 2011.
2. Low-Voltage, Low-Power VLSI Subsystems–Kiat-SengYeo, Kaushik Roy, TMH Professional Engineering.

References:

1. Introduction to VLSI Systems: A Logic, Circuit, and System Perspective – Ming-Bo Lin, CRC
   Press, 2011.
2. Low Power CMOS Design–Anantha Chandrakasan, IEEE Press/Wiley International, 1998.
3. Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley&Sons, 2000.

IV B.Tech I Sem (E.C.E)

23BTEC24bT	**WIRELESS SENSOR NETWORKS**	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the fundamental concepts and architecture of wireless sensor networks.
2. To explore various network architectures, optimization techniques, and design principles for wireless sensor networks.
3. To study MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.
4. To understand the infrastructure establishment of sensor networks, including topology control and synchronization.
5. To provide knowledge on sensor network platforms, programming challenges, and simulation tools.

Course Outcomes:

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

1. Learn the fundamental concepts and architecture of wireless sensor networks.
2. Explore various network architectures, optimization techniques, and design principles for wireless sensor networks.
3. Gain knowledge of MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.
4. Understand the infrastructure establishment of sensor networks, including topology control and synchronization.
5. Grasp the knowledge on sensor network platforms, programming challenges, and simulation tools.

UNIT-I

Overview of Wireless Sensor Networks: Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks.

UNIT-II

Architectures: Network Architecture- Sensor Networks-Scenarios- Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT-III

NetworkingSensors: MAC Protocols for Wireless Sensor Networks, LowDutyCycleProtocols and Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols, Energy-Efficient Routing, Geographic Routing.

UNIT-IV

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT-V

Sensor Network Platforms and Tools: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

Textbooks:

1. HolgerKarl&AndreasWillig, "Protocols and Architectures for Wireless Sensor Networks‖, John Wiley, 2005.
2. FengZhao&LeonidasJ.Guibas,―Wireless Sensor Networks-An Information Processing Approach", Elsevier, 2007

ReferenceBooks:

1. WaltenegusDargie,Christian Poellabauer,―Fundamentals Of Wireless Sensor Networks Theory And Practice‖, By John Wiley & Sons Publications, 2011
2. Kazem Sohra by, Daniel Minoli,& Taieb Znati,―Wireless Sensor Networks-Technology, Protocols, and Applications‖, John Wiley, 2007.
3. AnnaHac,―Wireless Sensor Network Designs‖,JohnWiley,2003

IV B.Tech I Sem (E.C.E)

23BTEC24cT	**5G COMMUNICATIONS**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

1. To introduce the fundamental concepts of 5G spectrum, radio access technologies, and system requirements.
2. To understand the architecture and physical layer aspects of 5G networks, including MIMO and beam forming.
3. To explore advanced 5G radio-access technologies and their role in multi-user communication.
4. To study network slicing, SDN, NFV, and their applications in vehicular communications.
5. To analyze mobility management, interference control, and dynamic network reconfiguration in 5G.

Course Outcomes:

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

1. Understand the 5G radio spectrum and channel models, including spectrum sharing and propagation challenges.
2. Analyze the 5G network architecture, including the core network, RAN, and physical layer procedures.
3. Evaluate different 5G radio-access technologies, including new waveforms and non-orthogonal multiple access schemes.
4. Apply network slicing concepts and vehicular communication techniques for efficient 5G network deployment.
5. Develop strategies for mobility and handoff management to optimize network performance and minimize interference.

UNIT-I

5G Radio Spectrum: 5G spectrum landscape and requirements, Spectrum access modes and sharing scenarios, 5G spectrum technologies.

5G Channel Model: The 5G wireless Propagation Channels: Channel modeling requirements, propagation scenarios, and challenges in the 5G modeling.

5G Use Cases and System Concept: Use cases and requirements, 5G system concept.

UNIT-II

Radio Interface Architecture: 5G architecture options, core network architecture, RAN architecture. 5G PHYSICAL LAYER: Physical channels and signals, 5G frame structure, physical layer procedures (MIMO, Power control, link adaptation, beam forming).

UNIT-III

5G Radio-Access Technologies: Access design principles for multi-user communications, multi-carrier with filtering: a new waveform, non-orthogonal schemes for efficient multiple access

UNIT-IV

Introduction to 5G Network Slicing: Network Slicing, E2E Slicing, SDN and NFV Slicing

Vehicular Communications: From V2V to AV2X, key standards, VC architectures, V2X Use cases

UNIT-V

Mobility and Handoff Management in 5G: Network deployment types, Interference management in 5G, Mobility management in 5G, Dynamic network reconfiguration in 5G.

Textbooks:

1. Afif Osseiran, Jose F Monserrat, Patrick Marsch, ―5G Mobile and Wireless Communications
   Technology‖, Cambridge University Press,2016
2. SaadZ.Asif,―5G Mobile Communications Concepts and Technologies ‖,CRC Press, Taylor
   &Francis Group, First Edition, 2018
3. Harri Holma,Antti Toskala,TakehiroNakamura,―5G Technology 3G PPNEWRADIO‖, John Wiley & Sons First Edition,2020

References:

1. Gordon L.Stuber,―Principles of Mobile Communication ‖,KLUWER ACADEMIC PUBLISHERS, 2nd Edition, 2002
2. Joseph C. Liberti, Theodore S. Rappaport, ―Smart Antennas for Wireless Communications‖,
   Prentice Hall PTR,1999
3. Ying Zhang,―Network Function Virtualization Concepts and Applicability in 5G Networks‖, John Wiley & Sons, 2018.

IV B.Tech I Sem(E.C.E)

23BTEC14P	RF SYSTEM DESIGN TOOLS	L	T	P	C
		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.

UNIT-I:

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, Lmatch, Pimatch, Tmatch, Passive IC Components- Resistors, capacitors, Inductors, Schottky Diode, RF Switch.

UNIT-II:

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.

UNIT-III:

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.

UNIT-IV:

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.

UNIT-V:

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 an 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 equalize its gain using an Equalizer.
6. Design and simulate a High Frequency Oscillator and Lumped Filter.
7. Measurement of insertion loss,-3dB cut-off frequency of LPF, HPF, and BPF.
8. Design and Simulate a VCO and RF Mixer.
9. Measure the S parameters of a Microstrip Transmission Line and plot the normalized 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 their Insertion Loss (S21 and S12)
12. Study of different types of Microstrip discontinuities like Bend, T, Via, Gapetcand find/ measure their Insertion loss.
13. Determine the Bandwidth and Quality Factor of a Microstrip Ring Resonator.
14. Design and simulate the Radiation Pattern, gain, S11, and VSWR of a Microstrip Patch Antenna and Microstrip Array.
15. Design and simulate the Radiation Pattern, gain, S11 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.

IV B.Tech I Sem (E.C.E)

23BTEC15P	**INDUSTRIAL IOT AND AUTOMATION** **(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/ Node MCU 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 needs to be done)

MODULE 1: Introduction & Architecture

What is IIoT and the 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

MO DULE 2: IIOT Components

Fundamentals of Control Systems, introductions, components, closed-loop & open-loop systems.

Introduction to Sensors (Description and Working Principle): What is a sensor? Types of sensors, working principle of basic Sensors -Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11).Digital switch, ElectroMechanical 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) usingRaspberry Pi/Node MCU.

3. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberrypi Pi/NodeMCU.

MODULE 3: Communication Technologies of IIoT

Communication Protocols: IEEE802.15.4, ZigBee, Bluetooth, BLE, NFC, RFID Industry 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 IIoT.

Practice

1. Visualization of diverse sensor data using dashboard (part of IoT‘s_control panel‘)

2. Sending an alert message to the user provides 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, and 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 a ladder diagram.

2. Implementation of a Boolean expression using a ladder diagram.

3. Simulation of PLC to understand the process control concept.

Projects:

IIoT based smart energy meter

Smart Agriculture system

Automation using a controller via Bluetooth,

Temperature-controlled Fan /cooler using a 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: Cyber Manufacturing 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)

IV B.Tech I Sem (E.C.E)

23BTEC27T	**Gender Sensitization** **(Common to All Branches of Engineering)**	**L**	**T**	**P**	**C**
		0	1	2	2

Course Objectives:

- To enable students to understand the gender related issues, the vulnerability of women and men
- To familiarize them a bout constitutional safeguards 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 the wider community and the workplace.

Course Outcomes (CO):

COs	**Statements**	**Bloomlevel**
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 to understand how gender discrimination works in our Society and how to counter it.	L3
CO4	Analyze the gendered division of labour and its relation to politics and economics.	L4
CO5	Appraise how gender-role beliefs and sharing behavior are associated with well-being in all cultures and gender groups.	L5
CO6	Develop students‘ sensibility with regard to issues of gender	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 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. Watt, Robinand 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 Worldwide*, 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-BASEDVIOLENCE**

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-girlshttps://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 andBenefits: Opportunities of Green Buildings, Green Building Features, Material and Resources, WaterEfficiency, 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 the Indian Society of Heating, Refrigerating, and Air Conditioning Engineers, 2009.
2. GreenBuilding Handbook by Tom Woolley and Sam Kimings, 2009.

REFRENCE BOOKS:
1. Complete Guide to Green Buildings by Trish Riley **2.** Standard for the design of 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**	L	T	P	C
23A01505b	**(OPENELECTIVE –I)**	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 aspects in 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 estimation in 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 aspects in 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, R.H. Clough, John Wiley and Sons, 6th Edition, 2016. 2. Construction Project SchedulingandControl bySalehMubarak, 4th Edition, 2019 3. Pandey,I.M(2021)FinancialManagement12thedition.PearsonIndiaEducation Services Pvt. Ltd.		
REFRENCE BOOKS:		
1. Brien, J.O. and Plotnick, F.L., CPM in 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 8th Edition Stephens Nunnally. 4. Rhoden, MandCato B, Construction Management and Organisational 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 - Fire extinguishers for electrical safety.

UNIT-II

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 handheld 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 inspectors

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. KennethG.Mastrullo, Ray A. Jones,―TheElectricalSafetyProgramBook‖, Jones and Bartlett Publishers, London, 2nd Edition, 2011.
2. Palmer Hickman, ―Electrical Safety-Related Work Practices‖, Jones & Bartlett Publishers, London, 2009.
3. FordhamCooper, W.,―Electrical Safety Engineering‖, Butterworth and Company, London, 1986.
4. John Cadick, Mary Capelli-Schellpfeffer, Dennis K. Neitzel,―Electrical Safety Handbook, McGraw-Hill, New York, USA, 4th edition, 2012.

B.TECH-ME-III-ISem

23A03505	**SUSTAINABLE 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 of the impact of solar radiation, solar PV modules
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 biomass
5	To gain insight into 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 biomass 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.

SOLARPV 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, and 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, biofuels, I.C. engine operation, and economic aspects.

UNIT– 5

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

OCEAN ENERGY: OceanThermal 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.andJ.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.DRoy/ 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, and using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding, and how to use exceptions.
- Handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java for 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, and 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-ForEach 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 Arrayto Another Array, Dynamic Change of ArraySize, 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 Inheritance, Universal Super Class Object 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 a 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, TemporalAdjusters 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 FXGUI: Java FX Scene Builder, Java FX AppWindow 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, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

Reference Books:

1. The Complete Reference Java,11th edition, Herbert Schildt, TMH

2. Introduction to Java programming ,7thEdition,YDaniel Liang, Pearson

Online Learning Resources:

1. *https://nptel.ac.in/courses/106/105/106105191/*
2. *https://infyspring board.onwing span.com/web/en/app/toc/lex_auth_012880464547 618816347 _shared /overv*iew

III B.Tech I Sem

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

Probabilistic Reasoning:

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.Richand K.Knight(TMH)
2. Artificial Intelligence,3rd Edn., Patrick HennyWinston, 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.

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.

Syllabus:

UNIT I:
Fundamentals of Quantum Mechanics (7 Hours)

- Classical vs Quantum Paradigm
- Postulates of Quantum Mechanics
- Wave Function 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
- QuantumLogic 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 (7Hours)

- Teleportation & No-Cloning
- BB84 Protocol
- Quantum Networks & Repeaters
- ClassicalvsQuantumCryptography
- Challenges in Implementation

UNIT IV:
Quantum Sensors and Metrology

- QuantumSensing: 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 AlastairI.M.Rae
• "An Introduction to Quantum Computing" by Phillip Kaye, Raymond Laflamme, and Michele Mosca
• IBM Quantum Experience and Qiskit Documentation (https://qiskit.org/)

III B.Tech I Sem

		L	T	P	C
23A54501	**MATHEMATICS FOR MACHINE LEARNING AND AI (Open Elective 1)**	**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 analyzing mathematical formulations in AI/ML.

Course Outcomes:

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

COs	Statements	Bloomslevel
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**=StrongMapping, **2**=ModerateMapping, **1**=Slight Mapping,**-**=NoMapping

UNIT-I: Linear Algebra for Machine Learning (08)

Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigen values,eigen vectors, 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, and the 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.AldoFaisal, Cheng Soon Ong, Cambridge University Press, 2020.

2. Pattern Recognition and Machine Learning by Christopher Bishop, Springer.

Reference Books:

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

Web References:

- MIT– Mathematics for Machine Learninghttps://ocw.mit.edu
- StanfordCS229–Machine Learning Course https://cs229.stanford.edu/

Deep AI– Mathematical Foundations forAIhttps://deepai.org

III B.Tech I Sem

		L	T	P	C
23A56501	**MATERIALS CHARACTERIZATION TECHNIQUES** (Common to all branches)(Open Elective-Interdisciplinary) **(Open Elective-I)**	**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 the Scanning electron microscope -Principle, limitations, and applications.
4	To illustrate the working of the Transmission Electron Microscope (TEM)-SAED patterns and their applications.
5	To educate the users of advanced electric and magnetic instruments for characterization.

	Course Outcomes	**BloomsLevel**
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 a 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

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 MicroscopyTechnique-2 -Transmission ElectronMicroscopy(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, Advantages 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 the induction method, Vibrating Sample Magnetometer (VSM), and SQUID.

Text books:

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, JohnWiley & Sons Ltd., 2008

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine 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**-SamZhang, LinLi, 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 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 photochemical cells, reactions and applications
4	Necessity of harnessing alternative 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 the liquification method.

COURSE OUTCOMES	
CO1	➢ Solve the problems based on electrode potential. Describe the Galvanic Cell. ➢ Differentiate between lead-acid and lithium-ion batteries, and illustrate the electrical double layer.
CO2	➢ Describe the working Principle of a Fuel cell. Explain the efficiency of the fuel cell. ➢ Discuss a bout the Basic design of fuel cells. Classify the fuel cell.
CO3	➢ Differentiate between Photo and photoelectrochemical Conversions, illustrate the photochemical cells, and identify the applications of photochemical reactions. ➢ Interpret the advantages of photoelectron catalytic conversion.
CO4	➢ Apply the photo voltaic technology, demonstrate a bout solar energy and prospects. ➢ Illustrate the Solar cells, Discuss a bout concentrated solar power.
CO5	➢ Differentiate Chemical and Physical methods of hydrogen storage, discuss the metal organic framework, and 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 Photoelectrochemical Conversions: Photochemical cells Introduction and applications of photochemical reactions, specificity of photoelectrochemical cell, advantage of photoelectrocatalytic 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 IraN.Levine
2. Essentials of Physical Chemistry, Bahland, Bahl, and Tuli.
3. In organic Chemistry, Silver and Atkins

Reference Books:

1. Fuel Cell HandBook7thEdition,by US Department of Energy (EG&Gtechnicalservices And corporation)
2. Handbook of Solar Energy and Applications by Arvind Tiwari and Shyam.
3. Solar Energy Fundamentals, Technology and Systems by Klaus Jagaret. 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 a bout 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 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 performing better in competitive exams L3

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

Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefinite-Degrees ofComparison-Adverbs-types- errors-Conjunctions-usage-repositions-usage-TagQuestions,types-identifyingerrors-Practice

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

Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause-Voice-activevoice 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 VOCABULARY**	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-Crackingtheunknowingpassage-speedreadingtechniques-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 MohanPrasad, *Objective English for Competitive Examination*, Tata McGraw-Hill, New Delhi, 2014.
2. PhilipSunilSolomon, *English for Success in Competitive Exams*, Oxford 2016
3. ShaliniVerma, *Word PowerMadeHandy*, 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 Publishers2013.
6. MichelSwan, *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 (OpenElective-I)**	**L**	**T**	**P**	**C**
		3	0	0	3

COURSE OBJECTIVES: The objectives of this course are	
1	To foster an entrepreneurial mindset 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

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 design thinking, identify market potential and customers while developing a compelling value proposition solution	L3
CO3	Analyze and refine business models to ensure sustainability and profitability.	L3
CO4	Build a Prototype for Proof of Concept and validate the MVP of their practice venture idea.	L4
CO5	Create a 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 Stake holders	L6

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 an entrepreneurial mindset, skill sets, attributes, and networks while on campus.

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

LEARNING OUTCOMES

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

- Understand the concept of Entrepreneur and Entrepreneurship in India
- Analyze recent trends in the Entrepreneurship role in economic development
- Develop a creative mindset 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 the problem using Design thinking principles –Analysing the 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 the problem and validate with a 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 customers' needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features, and benefits - Assessing relative market position via competition analysis - Sizing the market and assessing scope and potential scale of the opportunity.

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

LEARNING OUTCOMES

At the end of 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 can be a model, riskiest assumptions to Business models. Importance of the Build - Measure – Lean approach.

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

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

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

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

CoreTeachingTool: 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 the 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-à-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 a spiration for scale
- Analyze the 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*,Mc GrawHill,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.*BusinessModel Generation: A Handbook for Visionaries, Game Changers, and Challengers*.JohnWiley&Sons.(2010).

REFERENCES

1. SimonSinek, *Start with Why*, Penguin Books Limited. (2011)
2. BrownTim,*Changeby DesignRevised&Updated:HowDesign 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

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

III B. Tech. II Semester

Course Code	**DISASTER MANAGEMENT**	L	T	P	C
23A01606a	**(OpenElective–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 Structures in 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, BoundaryWalls, 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. DavidAlexander, *Natural Disasters*,1st Edition, CRC Press,2017.
2. EdwardA.KellerandDuaneE.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. DamonP.Coppola, *Introduction to International Disaster Management*, 4th Edition, Butterworth-Heinemann, 2020.

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

OnlineLearningResources:

https://nptel.ac.in/courses/124107010https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

III B.Tech– II Semester

CourseCode	**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 to 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 lifecycle assessment.
3. Apply energy calculations to 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 EnergyVia-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. CharlesJKibert, 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 Practices in the Built Environment, Butterworth Heinemann Publishers, 2011. 2. WilliamPSpence, 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**	**L**	**T**	**P**	**C**
	(OpenElective-II)	**3**	**0**	**0**	**3**

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

CO1: Understand the principle operation of various renewable energy sources. L1

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

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

CO4: 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 the 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 PVEnergySystems:

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, geopressured hot dry rock, magma.Advantages, disadvantages, and applications 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.

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

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

Textbooks:

1. G.D.Rai,— Non-ConventionalEnergySources‖,4th Edition, Khanna Publishers,2000.

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

ReferenceBooks:

1. StephenPeake,— RenewableEnergyPowerforaSustainableFuture‖, Oxford International Edition, 2018.

2. S.P.Sukhatme,— Solar Energy‖,3rd Edition, Tata McGraw-Hill Education Pvt.Ltd,2008.

3. BHKhan,— Non-Conventional Energy Resources‖, 2nd Edition, Tata McGraw Hill Education Pvt Ltd, 2011.

4. S.Hasan SaeedandD.K.Sharma,—Non- Conventional Energy Resources‖,3rdEdition,S.K.Kataria& Sons, 2012.

5. G.N.TiwariandM.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	Familiarityofindustrialautomationandrobotics, 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, and 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 scenarios to analyze and design automated and robotic systems.	L3,L4,L5
5	Design, program, and implement robotic systems, and 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 flowlines:

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, and 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, Homogeneous 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/PearsonEdu.
2. IndustrialRobotics-M.P.Groover, TMH. 3.

References:

1. Robotics, Fu KS, 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 RK & Nagrath, IJ, 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**
	(OpenElective-II)	**3**	**0**	**0**	**3**

Course Objectives: The main objectives of the course are to make students

- 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 the 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 8 Hrs

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, attachment, Disk scheduling, RAID structure, and 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. Silber Schatz A, Galvin PB, 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.)

ReferenceBooks:

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. StallingsW,OperatingSystems-InternalsandDesignPrinciples,6thedition,Pearson Education, 2009

4. NuttG,OperatingSystems,3rdedition,PearsonEducation,2004

Online Learning Resources:

https://nptel.ac.in/courses/106/106/106106144/http://peterindia.net/Operat

ingSystems.html

III B.Tech–II Sem

23A32501T	**INTRODUCTION TO MACHINE LEARNING**	**L**	**T**	**P**	**C**
	(Open Elective-II)	**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 the 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, Ada Boost, 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. TomMitchell, **Machine Learning**, McGraw-Hill Education.
2. Aurélien Géron, **Hands–On Machine Learning with Scikit-Learn, Keras, and Tensor Flow**, 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. KevinP. 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-learnDocumentation
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** (Open Elective-II)	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 the meaning, purpose, and 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 problems involving non-linear constraints and objectives.	L2, L3
CO5	Apply the concept of unconstrained geometric programming for solving problems involving nonlinear 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, and Big-M method.

UNIT–II Linear Programming II: Duality in Linear Programming

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. HarveyM.Wagner, Principles of Operations Research, Prentice-Hall of India Pvt.Ltd, New Delhi.
2. PeressimiA.L., Sullivan F.E., Vhl, J.J.MathematicsofNon-linearProgramming, 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 the 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 the composite system and the measuring process.

Course Outcomes:

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

COs	Statements	Bloomslevel
CO1	Understand the Transformation theory and Hilbert space.	L1 (Understand)
CO2	Analyze the properties and operators of Hilbert space and apply eigenvalues 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 the composite system and the 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=StrongMapping,**2**=ModerateMapping,**1**=SlightMapping,**-** =NoMapping

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 Eigen value Problem, Degression on the Existence and Uniqueness of solutions of the Eigen value 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, McGraw-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

		L	T	P	C
23A56601	**PHYSICS OF ELECTRONIC MATERIALS AND DEVICES** **(Common to all branches)** **Open Elective-II**	**3**	**0**	**0**	**3**

	Course Objectives
1	To make the students 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.

	Course Outcomes	**BloomsLevel**
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

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, Hetero junctions, Transistors, MOSFETs.

UNIT IV Excitons and Luminescence:

Luminescence: Different types of luminescence, basic definitions, Light emission solids, Inter-band luminescence, Direct and indirect gap materials.

Photo luminescence: 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. PrinciplesofElectronicMaterialsandDevices-S.O.Kasap,McGraw-HillEducation(India)Pvt. Ltd., 4th edition, 2021.
2. Semiconductors, Physics & Devices: basic principles, 4th Edition, McGraw-Hill,2012.

ReferenceBooks:

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, Dhanpat Rai 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 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

23A51601	**CHEMISTRY OF POLYMERS AND APPLICATIONS** (**Common to all branches**) **OpenElective-II**	**L**	**T**	**P**	**C**
		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 hydrogel polymers
5	To enumerate applications of conducting and degradable polymers in engineering.

Course Outcomes	
CO1	Classify the polymers, explain the polymerization mechanism, and differentiate addition, Condensation polymerizations, Describe the measurement of the molecular weight of a polymer.
CO2	Describe the physical and chemical properties of natural polymers and modified cellulosics.
CO3	Differentiate between Bulk, solution, Suspension, and emulsion polymerization. Describe fibers and elastomers, and identify the thermosetting and thermopolymers.
CO4	Identify types of polymer networks, and describe methods involved in hydrogel preparation. Explain applications of hydrogels in drug delivery.
CO5	Explain the 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, Co-polymerization 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, Thermo-setting 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 Polymernetworks

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. Textbook of Polymerscience, 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 – Concise – 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, Proofreading - 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 Paper back – 1 January 2010 Pearson Education; First edition (1 January 2010) 2. Pease, Allan & Barbara.The Definitive Book of Body Language RHUS Publishers,2016

ReferenceBooks: 1. Alice Savage, Masoud Shafiei. Effective Academic Writing, **2 Ed.,** 2014, Oxford University Press. 2. Shalini Verma, *Body Language*, S Chand Publications, 2011. 3. Sanjay Kumar and Pushpalata, *Communication Skills*2E2015, Oxford. 4. Sharon Gerson, Steven Gerson, *Technical Communication Process and Product*, Pearson, New Delhi, 2014 5. *Elbow, Peter.Writing with Power.OUPUSA,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 ad mixtures.
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

Stones and Bricks, Tiles: Building Stones – Classifications and Quarrying – Properties – Structural Requirements – Dressing. Bricks – Composition of Brick, Earth – Manufacture and Structural Requirements, Fly Ash, Ceramics.Timber, Aluminum, Glass, Paints, and Plastics: 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, Masonry and Finishing‘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 and Types; 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 GCSahu, Joygopal Jena, McGraw-Hill Pvt Ltd, 2015.
REFRENCE BOOKS:
1. Building Construction by B.C.Punmia, Ashok Kumar Jain, and ArunKumar Jain-Laxmi Publications (P) ltd., New Delhi 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 EIAMethodology, EIA 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 L and Use Introduction and Methodology for The Assessment of Soil and Groundwater, Delineation of the Study Area, Identification of Actives. Procurement of Relevant Soil Quality, Impact Prediction, Assessment of Impact Significance, Identification and Incorporation of Mitigation Measures. EI 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, Concept of ISO, 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. McGraw-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,byH.S.Bhatia, Galgotia Publication (P) Ltd, Delhi

OnlineLearningResources:

https://archive.nptel.ac.in/courses/124/107/124107160/

IV B.Tech I Sem

23A02704	**SMART GRID TECHNOLOGIES**	**L**	**T**	**P**	**C**
	(OpenElective-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 Synchrophasor 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 SmartGrid–

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,"SmartGrid–Integrating Renewable,Distributed andEfficient Energy", 1st Edition, Academic Press, USA, 2011.
3. Stuart Borlase, "SmartGrids: 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.

IVB.Tech I Sem

23A03704	**3D PRINTING TECHNOLOGIES (Open Elective-III).**	**L**	**T**	**P**	**C**
		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 with** 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), Ballistic 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, 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, and Medical Applications of RP.

Textbooks:

1. CheeKaiChuaandKahFaiLeong,― 3DPrintingandAdditiveManufacturingPrinciplesand Applications‖ 5/e, World Scientific Publications, 2017.

2. IanGibson, David W. Rosen, Brent Stucker,―AdditiveManufacturingTechnologies:3D Printing, Rapid Prototyping, and Direct Digital Manufacturing‖, Springer, 2/e, 2010.

Reference Books:

1. FrankW.Liou,― RapidPrototyping&EngineeringApplications‖, CRC Press, Taylor & Francis Group, 2011.

2. RafiqNoorani,― RapidPrototyping:PrinciplesandApplicationsinManufacturing‖,John Wiley&Sons, 2006.

Online Learning Resources:

- NPTELCourseonRapidManufacturing.
- 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.

IVB.Tech-I Sem

23A05402T	**DATA BASE MANAGEMENT SYSTEM** (OpenElective-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 No SQL 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. **PramodJ.Sadalage&MartinFowler**–***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 No SQL Databases**
5. **W3Schools SQL Tutorial**
6. **Geeks for Geeks–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 the 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 cyberattack tools and methods, such as phishing, keyloggers, Trojans, and SQL injection, used in committing cybercrimes.
5. Assess the organizational implications of cyber crimes, 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 Cafes 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 and 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 Howardand Ryan Otson, CRC Press.

2. Introduction to Cyber Security, Chwan-Hwa(john)Wu,J.DavidIrwin.CRCPressT&F Group

Online Learning Resources:

http://nptel.ac.in/courses/106105031/40http://nptel.i

n/courses/106105031/39http://nptel.ac.in/courses/10

61 05031/38

IV B.Tech I Sem

23A54701	**WAVELET TRANSFORMS AND ITS APPLICATIONS**	**L**	**T**	**P**	**C**
	(Open Elective-III)	**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 and ad scaling functions	L3, L5
CO3	Implement discrete wavelet transforms with multirate digital filters	L3
CO4	Understand multiresolution 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-AParseval'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.SidneyBurrus, Ramesh A.Gopinath,―IntroductiontoWaveletsandWaveletsTransforms‖, Prentice Hall, (1997).
2. James S. Walker, ―A Primer on Wavelets and their Scientific Applications‖, CRC Press, (1999)..

REFERENCES:

1. Raghuveer Rao,―Wavelet Transforms‖, Pearson Education, Asia
2. C.S.Burrus,RamoseandA.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 phenomena behind the working of smart materials
3	To explain the properties exhibited by smart materials
4	To educate on various techniques used to synthesize and characterize mart materials
5	To identify the required smart material for distinct applications/devices

	Course Outcomes	**Blooms Level**
CO1	Identify key discoveries that led to modern applications of shape memory materials, and 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

CourseArticulationMatrix:

	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.

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. Mahmood Aliof khazraei,Handbookoffunctionalnanomaterials,Vol(1&2),NovaPublishers,2014

3. **Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0,** Chaudhery

Mustansar Hussain, PaoloDiSia, 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**

23A56701b	**INTRODUCTION 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, the uncertainty principle, and their implications.
3	To learn and apply the 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.

	Course Outcomes After completing this course, students will be able to:	**Bloom s 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

Course Articulation Matrix:

	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

UNIT-I:

PRINCIPLES OF QUANTUM MECHANICS

Introduction: Limitations of classical Mechanics, Difficulties with classical theories of black body radiation, and the origin of the quantum theory of radiation.Wave-particle duality: de Broglie wavelength, Heisenberg uncertainty principle.Schrödinger time-independent and time-dependent wave equations, 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 FOR MALISM

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 brand ket notation, Expectation values, Heisenberg (operator) representation of the harmonic oscillator, Ladder operators, and their significance.

UNIT-V:
ANGULAR MOMENTUM AND SPIN

Angular momentum operators: Definition. Eigen functions and eigenvalues 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 eigenvalues.

BOOKS FOR STUDY:

1. Quantum Mechanics.Vol. A. Messaia Noth-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-Wesley Co. Inc., London, (1960).
4. Quantum Mechanics.S.L.Gupta,V.Kumar, H.V.Sarama and R.C.Sharma,Jai Prakash Nath&Co, Meerut, (1996).

REFERENCE BOOKS:

1. Quantum Mechanics. L.I.Schiff, McGraw-Hill Book Co., Tokyo, (1968).
2. Introduction to Quantum Mechanics. Richard L.Lib off, Pearson Education Ltd (Fourth Edn.)2003.

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**

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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 principles 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 sources of green energy.
5	To apply alternative, greener methods for chemical reactions

Course Outcomes	
CO1	Apply the Green chemistry Principles for day to day-to-day life as well as synthesis, describe the sustainable development and green chemistry, and explain economic and uneconomic reactions, and 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 their importance, discuss supercritical carbon dioxide, Explain Supercritical water, and recycling of green solvents.
CO4	Describe the importance of Biomass and Solar Power, illustrate Sono chemistry, Apply Green Chemistry for Sustainable Development, discuss the importance of Renewable resources. Mechanochemical synthesis.
CO5	Discuss Alternative green methods like Photo redoxcatalysis, 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 uneconomic 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: Supercritical carbon dioxide, supercritical water, Polyethyleneglycol(PEG), Ionic liquids, Recycling of green solvents.

UNIT-4: EMERGING GREENER TECHNOLOGIES

Biomass as a renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstocks, 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. GreenChemistryforEnvironmentalSustainability, First Edition, Sanjay K.Sharma and AckmezMudhoo, CRC Press, 2010.

2. EditedbyAlvisePerosaandMaurizioSelva,HandBookofGreenchemistryVolume8: GreenNanoscience,wiley-VCH,2013.

IVB.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- Email 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. SabinaPillai, Agna Fernandez.*Soft Skills & Employability Skills***,** 2014.Cambridge Publisher.
2. Alka Wadkar.LifeSkillsforSuccess, Sage Publications,2016.

ReferenceBooks:

1. GangadharJoshi.CampustoCorporatePaperback, Sage Publications 2015
2. Sherfield, Montgomery, Moody, Cornerstone, Developing Soft Skills, Pearson Publications, 4 Ed., 2008
3. ShikhaKapoor.*Personality Development and Soft Skills-Preparing for Tomorrow*.1 Edition, Wiley, 2017.
4. M.SenGupta, *Skills for Employability*, Innovative Publication,2019.
5. SteveDuckandDavidTMcMahan**,** *The Basics of Communication Skills: A Relational Perspective*, Sage Press, 2012.

OnlineLearningResources:

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 and geostatistical 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 and geostatistical 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, WEBGIS, 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– TsungChang, Introduction to Geographical Information Systems, 4th Ed., Tata McGraw-Hill Edition, 2008.
2. Lo, C.P. and Yeung, Albert K.W., Concepts and Techniques of Geographic Information Systems, Prentice Hall, 2002.

REFRENCE BOOKS:

1. MichaelN.Demers, Fundamentals of Geographic Information Systems, Wiley,2009
2. IanHeywood, Sarah Cornelius, Steve Carver, Srinivasaraju,―An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
3. JohnPeterWilson, 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

CIVILENGINEERING					
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 land fill 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 Systems for Solid 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; Pyrolysis, 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, TheisenHandVigilSA_IntegratedSolidWasteManagement, 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,_EnvironmentalEngineering‘, McGraw Hill, NewYork,1985. 2.QianX, Koerner RM, and GrayDH,_GeotechnicalAspectsofLandfillDesignand Construction‘, Prentice Hall, 2002.		
OnlineLearningResources:		
https://archive.nptel.ac.in/courses/105/103/105103205/https://archive.nptel.ac.in/courses/120/108/120108005/		

IVB.Tech I Sem

23A02705	**ELECTRIC VEHICLES** (Open Elective-IV)	L	T	P	C
		3	0	0	3

Course Objectives: To make the student

- Remember and understand the differences between conventional vehicles and electric vehicles, electromobility, and the 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 an electric vehicle.

Course Outcomes (CO): Students will be able to

CO1: To understand and differentiate between Conventional Vehicles and Electric Vehicles, electromobility, and environmental issues of EVs.-L2

CO2: Understand Various dynamics of ElectricVehicles.-L2

CO3: To remember and understand various configurations in the parameters of the EV system and the dynamic aspects of EV-L1

CO 4: To analyze fuel cell technologies in EV and HEV systems. -L3

CO5: 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 parameters: Weight, size, force, and energy, performance parameters. Electromobility and the environment-History of Electric power trains- Carbon emissions from fuels- Greenhouses 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 electromechanical 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., New York, 2001, 1st Edition

2. AliEmadi,―Advanced Electric DriveVehicles‖,CRCPress,2017,1stEdition

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 – ISBN-978-1-84919-219-4), Second Edition, 2011.

4. Mehrdad Ehsani, YimiGao, Sebastian E.Gay, Ali Emadi,―Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design‖, CRC Press, 2004, 1st Edition

5. James Larminie, John Lowry,―ElectricVehicleTechnologyExplained‖, 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 (OpenElective-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	Exposure to various quality issues in Inspection.
3	Gain Knowledge on quality control and its applications in 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 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 the 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 to TQM Implementation, Benefits of TQM, Characteristics of a 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. DaleH Besterfield, Total Quality Management, Fourth Edition, Pearson Education,2015.
2. SubburajRamaswamy, Total Quality Management, Tata McGraw-Hill Publishing Company Ltd., 2005.
3. JoelE.Ross, Total Quality Management, Third Edition, CRC Press, 2017.

ReferenceBooks:

1. NarayanaVand SreenivasanN.S., Quality Management–Concepts and Tasks, NewAge International, 1996.
2. RobertL.Flood, Beyond TQM, First Edition, JohnWiley&SonsLtd,1993.
3. Richard S.Leavenworth&EugeneLodewickGrant, 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/

IVB.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 the design of computer networks
- Expose the network protocols used in the Internet environment
- Explain the format of the headers of IP, TCP, and UDP
- Familiarize with the applications of the 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 (Textbook1) 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: 8Hrs**

Routing Algorithms, Internet working, The Network Layer in the Internet (Textbook1)

UNIT-IV:

The Transport Layer **Lecture: 9Hrs**

Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

UNIT-V:

The Application Layer **Lecture: 8Hrs**

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. AndrewS.Tanenbaum, David J.Wetherall, *Computer Networks*, 6th Edition, PEARSON.
2. JamesF.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. YouluZheng, 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 (OpenElective-IV)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- Understand the basics of the 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, and 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 the 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, Deregistering a device, Introduction to Cloud Storage models and communication APIs, Web-Server, Web server for IoT.

UNIT-V
UAV IoT

Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultrasonic sensors; UAV Software –Ardupilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Textbooks:

1. Vijay Madisetti and Arshdeep Bahga, ―Internet of Things (A Hands-on-Approach)‖, 1st Edition, VPT, 2014.
2. Handbook of Unmanned Aerial Vehicles, KValavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts: Credo Reference, 2014. 2016.

ReferenceBooks:

1. Jan Holler, Vlasios Tsiatsis, 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. Arshdeep Bahga, 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. FrancisdaCosta,―Re thinking the Internet of Things:AScalableApproachtoConnecting 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. DGCARPAS Guidance Manual, Revision 3– 2020
7. Building Your Own Drones: A Beginner's Guide to Drones, UAVs, and ROVs, John Baichtal

OnlineLearningResources:

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. ChrisBernhardt, Quantum Computing for Everyone, MIT Press,2019.

Reference Books:

1. DavidMc Mahon, Quantum Computing Explained, Wiley,2008.
2. PhillipKaye, Raymond Laflamme, MicheleMosca, 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 UCBerkeley**
3. edX–The Quantum Internet and Quantum Computers
4. **YouTube–Quantum Computing for the Determined by MichaelNielsen**
5. QiskitTextbook –IBMQuantum

IV B.Tech I Sem

23A54702	**FINANCIAL MATHEMATICS** (OpenElective-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	Bloomslevel
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 asMonte 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**=StrongMapping, **2**=ModerateMapping, **1**=SlightMapping,-=NoMapping

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 Lookbacks. 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&StevenE.Shreve, *Methods of Mathematical Finance*, Springer, NewYork.
2. JohnC.Hull, *Options, Futures, and Other Derivatives*, Pearson.

Web References:

- MIT–MathematicsforMachineLearninghttps://ocw.mit.edu
- Coursera–FinancialEngineeringandRiskManagement(ColumbiaUniversity) https://www.coursera.org/
- NationalStockExchange(NSE)India–FinancialDerivativeshttps://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 phenomena behind the working of sensors and actuators
3	To explain the operating principles of various sensors and actuators
4	To educate on the fabrication of sensors
5	To explain the required sensors and actuators for interdisciplinary applications

	Course Outcomes	**BloomsLevel**
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

CourseArticulationMatrix

	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	-							

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: Piezo resistive, Variable Reluctance Sensor (VRP).

UNIT-III Optical and Acoustic Sensors **9H**

Optical Sensors: Basic principles 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, Magne to strictive sensors and actuators.

UNIT-V Chemical and Radiation Sensors **9H**

Chemical Sensors: Principles 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.deSilva, CRC Press, 2nd Edition,2015

2. Sensors and Actuators, D.A.Hall and C.E.Millar,CRC Press,1999

ReferenceBooks:

1. Sensors and Transducers-D.Patranabhis,PrenticeHallofIndia(Pvt)Ltd.2003

2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC Press, 1999

3. Sensors–AComprehensiveSensors-HenryBolte, John Wiley.

4. Handbookofmodernsensors,Springer,StefanJohannRupitsch.

NPTELcourselink:https://onlinecourses.nptel.ac.in/noc21_ee32/preview

IV B.Tech I Sem

		L	T	P	C
23A51702	**CHEMISTRY OF NANO MATERIALS AND APPLICATIONS (Open Elective-IV)**	3	0	0	3

Course Objectives	
1	To understand the basics and characterization of nanomaterials.
2	To understand the synthetic methods of nanomaterials.
3	To apply various techniques for the characterization of nano materials.
4	To understand Studies of Nano-structured Materials
5	To enumerate the applications of advanced nanomaterials in engineering

Course Outcomes	
CO1	Classify the nanostructured materials; describe the scope of nanoscience and its importance technology.
CO2	Describe the top-down approach, explain aerosol synthesis and plasma arc technique, differentiate the chemical vapor deposition method and electrode position method, and discuss high-energy ball milling.
CO3	Discuss different techniques for characterization of nano material, explain electron microscopy techniques for characterization of nanomaterial, and describe the BET method for Surface area analysis.
CO4	Explain the synthesis and properties, and applications of nanomaterials. Discuss Fullerenes and carbon nanotubes differentiate nanomagnetic materials and thermo thermo- electric materials, and nonlinear optical materials.
CO5	Illustrate advanced engineering applications of Water treatment, sensors, electronic devices, the medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, and 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 nanotechnology, 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, chemical vapour deposition method, electrodeposition method, high-energy 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, the BET method for surface area analysis, and 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 nanoparticles, nanorods, nanowires, 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, McGraw-Hill, 2007.
2. **Textbook of Nanoscience and Nanotechnology:** BS Murty, PShankar, Baldev Rai, BB Rath, and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; Ludo vicoCademrtiriand Ge of Frey, 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** **(OpenElective-IV)** (Common to all branches)	**L**	**T**	**P**	**C**

Course Objectives	
1	To inculcate a 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 on how books serve as a reflection of history and society
5	To provide practical wisdom and the 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 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 LordTennyson
2. Ain‘t Iwoman?-So journer 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 on -SomersetMaugham
2. The HappyPrince-OscarWild
3. Three Questions – LeoTolstoy
4. Grief–AntonyChekov

UNIT-IV: Prose: Essay and Autobiography

1. Mystruggle for an Education-Booker TWashington
2. The Essentials of Education-Richard Livingston
3. The story of MyLife-HelenKeller
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. CharlesDickens**.***Hard Times.* (SangamAbridged Texts)VantagePress,1983
2. DENTJC.William Shakespeare.Twelfth Night**.**Oxford University Press,2016.

References:

1. WJ Long.*HistoryofEnglishLiterature***,**RupaPublicationsIndia;FirstEdition(4October 2015)
2. RKKaushikAndSCBhatia.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. DevNeira, Anjana & Co. *CreativeWriting: A Beginner's Manual.*PearsonIndia, 2008.

Online Resources

https://www.litcharts.com/poetry/alfred-lord-

tennyson/ulysseshttps://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 amplifiers and their performance with feedback and cascode configurations.
3. To analyze the design and performance of differential amplifiers in analog circuits.
4. To examine the characteristics and compensation techniques of operational amplifiers.
5. To understand the design principles of band gap 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 amplifiers and their performance with feedback and cascode configurations.
3. Analyze the design and performance of differential amplifiers in analog circuits.
4. Learn the characteristics and compensation techniques of operational amplifiers.
5. Understand the design principles of band gap reference circuits.

UNIT-I

Review of MOSFET device characteristics: Second order effects, MOS small signal model, 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, cascade 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

Single-stage amplifier: Analytical justification of operating region suitable for amplification/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 frequency response with parasitic affects, significance of cascode, design of cascade amplifier and with ideal current source load and practical cascade 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, small signal analyses, errors due to mismatch, replication principle, qualitative analysis, common mode response, Gilbert cell, Common centroid layout.

UNIT-IV

Operational amplifier: characterization, two-stage OP-amp, 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. Behzad Razavi, Design of Analog CMOS Integrated Circuit, McGraw-Hill Education, 2017, 2nd Edition.
2. PaulJ.Hurst, Paul R.Gray, Robert G., Meyer, and Stephen H. Lewis, Analysis and Design of Analog Integrated Circuits, Wiley, 2024, 6th Edition.
3. Mohammed Ismail and Terri Fiez, Analog VLSI: Signal and Information Processing, M C Graw Hill, 1994.

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. DavidJohns, TonyChanCarus one and KennethMartin, Analog Integrated Circuit Design, Wiley, 2011, 2nd Edition.
3. PaulG.A.Jespers and BorisMurmann, Systematic Design of Analog CMOS Circuits, Cambridge University 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. Todesign 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. Todesign 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 Parasitics, 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, The Adder: Circuit and Logic Design, 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, Anantha Chandrakasan, and BorivojeNikolic, Digital Integrated Circuits: A Design Perspective, Pearson, 2003, 2nd Edition.
2. JohnP.Uyemura, CMOSLogicCircuitDesign, Springer,2001.
3. JohnP.Uyemura, Introduction to VLSI Circuits and Systems, Wiley,2002.

REFERENCE BOOKS:

1. Sung-Mo Kang and Yusuf Leblebici, CMOS Digital Integrated Circuits, McGraw-Hill, 2003, 3rd Edition.
2. CharlesHawkins, Jaume Segura, and Payman Zarkesh- Ha, CMOSIntegratedDigitalElectronics: A First 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 architectures and 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 architectures and 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: Standard Adder Cells, Review of CMOS Adders Architectures and Performance Comparison, Low Voltage 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. Sources of power dissipation in SRAMs, Low-power SRAM circuit techniques, Sources of power dissipation in DRAMs, Low-power DRAM circuit techniques.

UNIT IV:

Architectural Techniques for Low Power: Parameters affecting 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. Kiat Seng Yeo and Kaushik Roy, Low-Voltage, Low-Power VLSI Subsystems, TataMcGrawHill, 2009.
2. SoudrisD, Piguet C and Goutis C, Designing CMOS Circuits for Low Power, Kluwer Academic Publishers, 2002.

References:

1. AbdellatifBellaouar,MohamedElmasry,Low-PowerDigitalVLSIDesign: Circuits and Systems, Springer,2012.
2. Jan Rabaey, LowPowerDesignEssentials, Springer,2009.

23A04H04	**TESTING AND VERIFICATION**	**L**	**T**	**P**	**C**
	Honors with VLSI specialization	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. Utilizes 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 algorithmsforfaultdetectionandimplementdesign-for-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:

Role of Testing in VLSI Design Flow, Testing at Different Levels of Abstraction, Fault, error, defect, diagnosis, yield, Types of testing, Rule of Ten, Defects in VLSI chip. Modelling basic concepts, Functional modelling at the logic level and register level, structure models, logic simulation, and 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, 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 the Scan chain-based testing method.

UNIT IV:

D-algorithm procedure, Problems, PODEM Algorithm. Problems with the PODEM Algorithm. FAN Algorithm. Problems on the 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, BIST Architectures, Testable memory design, Test algorithms- Test generation for Embedded RAMs.

Textbooks:

1. M.Abramovici,M.Breuer,andA.Friedman,―DigitalSystemsTestingandTestable Design, IEEE Press, 1990.
2. M.Bushnell and V.Agrawal, ―Essentials ofElectronicTestingforDigital, Memory & Mixed-Signal VLSICircuits‖, Kluwer Academic Publishers, 2000

References:

1. Stroud,―A Designer‘s Guide to Built-inSelf-Test‖, Kluwer Academic Publishers,2002
2. V.Agrawal and S.C.Seth, Test Generation for VLSI Chips, Computer Society Press, 1989

23A04H05	**FPGA ARCHITECTURES**	**L**	**T**	**P**	**C**
	HonorswithVLSIspecialization	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:

Introduction to FPGAs: Evolution of Programmable Devices, FPGA Design flow, Applications of FPGAs.

UNIT II:

Design Examples using PLDs: Design of Universal Block, Memory, Floating point multiplier, Barrel shifter.

UNIT III:

FPGAs/CPLDs: Programming Technologies, commercially available FPGAs, Xilinx‘s Vertex and Spartan, 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, and architectural assumptions for the FPGA

CASE STUDY–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-Inter science, 1995, 1st Edition.
2. Frank Bruno, FPGA Programming for Beginners, Packt,2021.
3. Frank Bruno and Guy Eschemann, The FPGA Programming Handbook, Packt, 2024, 2nd Edition.
4. StephenD.Brown, Robert J.Francis, Jonathan, Rose, and Zvonko G.Vranesic, Field Programmable Gate Arrays, Springer Science Business Media, LLC, 1992, 1st Edition.

References:

1. CliveMaxfield, The Design Warrior‘s Guide to FPGAs: Devices, Tools and Flows, Elsevier-Newnes,2004.
2. DatasheetsofArtix-7,Kintex-7,Virtex-7.

23A04H06	**ANALOG AND DIGITAL IC DESIGN LAB**	**L**	**T**	**P**	**C**
	Honors with VLSI specialization	0	0	3	1.5

Course Objectives:

1. To regain 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 gates using EDA tools.
5. To explore various architectures for arithmetic circuits such as adders, shift registers, and multipliers.
6. To gain hands-on experience in functional 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 a CMOS differential and two-stage operational amplifier 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 circuits till 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. Basic current sink, Cascode current sink.
6. Basic current source, Cascode current source.
7. Basic current mirror, Wilson current mirror,
8. Cascode current mirror,

9. Feedback topologies,
10. CMOS differential amplifier with current mirror load.
11. Two stage Operational amplifier.

Digital IC Design Lab

1. Design and Simulation of CMOS Inverter to study the transfer Characteristics by varying the design constraints using EDA Tools
2. Design and Simulation of logic gates using various logic styles and compare the performance

Design the following building blocks employing various architectures and develop HDL models:

3. 32-bit Parallel adder using 8-bit adder module,
4. 32-bit Shift register using an 8-bit Shift register module
5. Combinational and sequential multipliers: 8x8multiplier
6. Combinational and sequential multipliers:16X16multipliers
7. Perform the functional simulation, Static Timing Analysis, and post synthesis timing verification RTL to GDS-II: Design any System as a case Study

Text Books:

1. BehzadRazavi, Design of Analog CMOS Integrated Circuit, McGraw-Hill Education, 2017, 2nd Edition.
2. PaulJ.Hurst, Paul Gray, Robert G., Meyer, and Stephen Lewis, Analysis and Design of Analog Integrated Circuits, Wiley, 2024, 6th Edition.
3. Samir Palnitkar, Verilog HDL, Pearson Education,2003, 2nd Edition.
4. Erik Brunvand, Digital VLSI Chip Design with Cadence and Synopsys CAD Tools, Pearson, 2011.

Reference Books:

1. RandallL.Geiger, Phillip E. Allenand Noel 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, Verilog HDL Design Examples, CRC Press,2018.
4. Blaine Readler, Verilog by Example: A Concise Introduction for FPGA Design, Full ARC Press,2011.

23A04H07	**PHYSICAL DESIGN AUTOMATION LAB**	**L**	**T**	**P**	**C**
	Honors with VLSI specialization	0	0	3	1.5

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 path finding 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. Graph algorithms
   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 the Kernighan-Lin algorithm
     - Fiduccias–Mattheyses algorithm
     - Goldberg and Burstein algorithm
2. Simulated annealing and evolutionary algorithms
   - Simulated annealing algorithm
   - Simulated evolution algorithm
3. Metrical location 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 Floor planning 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