II YEAR
I SEMESTER

PROBABILITY THEORY AND STOCHASTIC PROCESS

Subject Code : UGBS3T0223	**L**	**T**	**P**	**C**
II Year/ I Semester	**3**	**0**	**0**	**3**

Prerequisites

- Linear Algebra & Calculus
- Differential Equations & Vector Calculus

Course Objectives

- To introduce the students about the fundamentals concepts of probability and random variables and Operations that can be performed on them.
- To know the Spectral and temporal characteristics of Random Process.
- To Learn the Basic concepts of Information theory Noise sources and its representation for understanding its characteristics

Course Outcomes: Upon the completion of the course, the student will be able to:

CO1. Outline the concept of random variables and solve probabilistic problems

CO2. Apply Statistical Operations and transformations on single and Multiple Random variable

CO3. Analyze the temporal and Spectral characteristics of Random Processes

CO4. Identify different types of noise and apply principles of source coding to improve the efficiency.

Syllabus

UNIT - I **(12 hours)**

Probability & Random Variable :Probability introduced 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, Bay's Theorem, Independent Events.

Random Variable-Definition, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variable, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Methods of defining Conditioning Event, Conditional Distribution, Conditional Density and their Properties.

UNIT - II **(28 hours)**

Operations on Single & Multiple Random Variables – Expectations :Expected Value of a Random Variable, Function of a Random Variable, Moments about the Origin, Central Moments, Variance and Skew, Chebychev's Inequality, Characteristic Function, Moment Generating Function, Transformations of a Random Variable : Monotonic and Non-

monotonic Transformations of Continuous Random Variable, Transformation of a Discrete Random Variable.

Vector Random Variables, Joint Distribution Function and its Properties, Marginal Distribution Functions, Conditional Distribution and Density – Point Conditioning, Conditional Distribution and Density – Interval conditioning, Statistical Independence. Sum of Two Random Variables, Sum of Several Random Variables, Central Limit Theorem, (Proof not expected). Unequal Distribution, Equal Distributions.

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, Transformations of Multiple Random Variables, Linear Transformations of Gaussian Random Variables

UNIT - III **(16 hours)**

Random Processes – Temporal Characteristics: 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, Mean-Ergodic Processes, Correlation-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Functions, Gaussian Random Processes, Poisson Random Process. Random Signal Response of Linear Systems: System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output.

UNIT - IV **(10 hours)**

Random Processes – Spectral Characteristics: The Power Spectrum: Properties, Relationship between Power Spectrum and Autocorrelation Function, The 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.

UNIT - V **(10 hours)**

Noise Sources & Information Theory : Resistive/Thermal Noise Source, Arbitrary Noise Sources, Effective Noise Temperature, Noise equivalent bandwidth, Average Noise Figures, Average Noise Figure of cascaded networks, Narrow Band noise, Quadrature representation of narrow band noise & its properties. Entropy, Information rate, Source coding: Huffman coding, Shannon Fano coding, Mutual information, Channel capacity of discrete channel, Shannon-Hartley law; Trade -off between bandwidth and SNR.

Mapping of COs to POs

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO1	3	3	0	3	0	0	0	0	0	0	0	0	0	0
CO2	3	3	0	3	0	0	0	0	0	0	0	0	0	0
CO3	3	3	1	3	0	0	0	0	0	0	0	0	0	0
CO4	3	2	2	1	0	0	0	0	0	0	0	0	0	0

TEXT BOOKS:

T1. Peyton Z. Peebles - Probability, Random Variables & Random Signal Principles, 4^{TH} Ed, TMH, 2001.

T2. Taub and Schilling - Principles of Communication systems, TMH, 2008

REFERENCE BOOKS:

R1. Athanasios Papoulis and S. Unnikrishna Pillai - Probability, Random Variables and Stochastic Processes, 4th Ed., PHI, 2002.

R2. B.P. Lathi - Signals, Systems & Communications, B.S. Publications, 2003.

UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Subject Code : UGBS3T0623	**L**	**T**	**P**	**C**
II Year / I Semester	**2**	**1**	**0**	**3**

Prerequisites : Basic Knowledge on Human Values

Course Objectives:

1) To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2) 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.
3) 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 : Upon completion of this course, the students will be able to:

CO1: Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)

CO2: Identify one's self, and one's surroundings (family, society nature) (L1, L2)

CO3: Apply what they have learnt to their own self in different day-to-day settings in real life (L3)

CO4: Relate human values with human relationship and human society. (L4)

CO5: Justify the need for universal human values and harmonious existence (L5)

CO6: Develop as socially and ecologically responsible engineers (L3, L6)

Syllabus

UNIT I (**6L – 3T)**

Introduction to Value Education : Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.

Practice Sessions: PS1 - Sharing about Oneself; PS2 - Exploring Human Consciousness; PS3 - Exploring Natural Acceptance.

UNIT II **(6L – 3T)**

Harmony in the Human Being : Understanding Human being as the Co-existence of the self and the body, Distinguishing between the needs of the self and the body, The body as an Instrument of the self, Understanding Harmony in the self, Harmony of the self with the body, Programme to ensure self-regulation and Health.

Practice Sessions: 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.

UNIT III **(6L – 3T)**

Harmony in the Family and Society : Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Practice Sessions: PS7 - Exploring the Feeling of Trust; PS8 - Exploring the Feeling of Respect; PS9 - Exploring Systems to fulfil Human Goal.

UNIT IV **(4L – 2T)**

Harmony in the Nature/Existence : Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.

Practice Sessions: PS10 - Exploring the Four Orders of Nature; PS11 - Exploring Co-existence in Existence.

UNIT V **(6L – 3T)**

Implications of the Holistic Understanding – A Look at Professional Ethics : Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models- Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.

Practice Sessions: PS12 - Exploring Ethical Human Conduct, PS13 - Exploring Humanistic Models in Education, PS14 - Exploring Steps of Transition towards Universal Human Order.

Mapping of COs to POs:

POs/ COs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO2	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO3	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO4	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO5	-	-	-	-	-	3	3	3	-	-	-	3	-	-
CO6	-	-	-	-	-	3	3	3	-	-	-	3	-	-

Text Books:

T1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, NewDelhi, 2019. ISBN978-93-87034-47-1

T2. R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN978-93-87034-53-2

Reference Books:

1	JeevanVidya:EkParichaya,ANagaraj,JeevanVidyaPrakashan,Amarkantak,1999.
2	HumanValues,A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.
3	TheStoryofStuff(Book).
4	TheStoryofMyExperimentswithTruth-byMohandasKaramchandGandhi
5	SmallisBeautiful-E.FSchumacher.
6	SlowisBeautiful-CecileAndrews
7	EconomyofPermanence-JCKumarappa
8	BharatMeinAngrejiRaj–PanditSunderlal
9	RediscoveringIndia-byDharampal

10	HindSwarajorIndianHomeRule-byMohandasK.Gandhi
11	IndiaWinsFreedom-MaulanaAbdulKalamAzad
12	Vivekananda-RomainRolland
13	Gandhi-RomainRolland

OnlineResources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-ndia.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

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.

SIGNALS AND SYSTEMS

Subject Code:UGEC3T0123	**L**	**T**	**P**	**C**
II Year/I Semester	**3**	**0**	**0**	**3**

Prerequisites

- Linear Algebra & Calculus
- Differential Equations & Vector Calculus

Course Objectives:

This course helps students to study about classification of signals and systems, To analyze the spectral characteristics of signal using Fourier series and Fourier transforms, to understand the characteristics of systems, To introduce the concept of sampling process and to know various transform techniques to analyze the signals and systems.

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

CO1. Differentiate the various classifications of signals and systems
CO2. Analyze the frequency domain representation of signals using Fourier concepts
CO3. Classify the systems based on their properties and determine the response of LTI Systems.
CO4. Analyse the sampling process and apply various types of sampling techniques in signals.
CO5. Apply Laplace and z-transforms to analyze signals and Systems (continuous & discrete).

Syllabus

UNIT- I **(10 Hours)**

INTRODUCTION: Definition of Signals and Systems, Classification of Signals, Classification of Systems, Operations on signals: time-shifting, time-scaling, amplitude-shifting, amplitude-scaling. Problems on classification and characteristics of Signals and Systems. Complex exponential and sinusoidal signals, Singularity functions and related functions: impulse function, step function signum function and ramp function. Analogy between vectors and signals, orthogonal signal space, Signal approximation using orthogonal functions, Mean square error, closed or complete set of orthogonal functions, Orthogonality in complex functions. Related problems.

UNIT–II **(10 Hours)**

FOURIER SERIES AND FOURIER TRANSFORM: Fourier series representation of continuous time periodic signals, properties of Fourier series, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series, Relation between Trigonometric and Exponential Fourier series, Complex Fourier spectrum. Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of

standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform, Related problems.

UNIT-III **(10 Hours)**

ANALYSIS OF LINEAR SYSTEMS: Introduction, Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear Time Variant (LTV)system, Concept of convolution in time domain and frequency domain, Graphical representation of convolution, Transfer function of a LTI system, Related problems. Filter characteristics of linear systems. Distortion less transmission through a system, Signal band width, system band width, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.

UNIT–IV **(08 Hours)**

CORRELATION: Auto-correlation and cross-correlation of functions, properties of correlation function, Energy density spectrum, Parseval's theorem, Power density spectrum, Relation between Convolution and correlation, Detection of periodic signals in the presence of noise by correlation, Extraction of signal from noise by filtering.

SAMPLING THEOREM: Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling –Aliasing, Introduction to Band Pass sampling, Related problems.

UNIT–V **(12 Hours)**

LAPLACE TRANSFORMS: Introduction, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.

Z–TRANSFORMS: Concept of Z-Transform of a discrete sequence. Region of convergence in Z Transform, constraints on ROC for various classes of signals, Inverse Z transform, properties of Z-transforms. Distinction between Laplace, Fourier and Z-transforms.

Mapping of CO's to PO's

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO 1	3	3	0	3	0	0	0	0	0	0	0	0	1	0
CO 2	3	3	1	3	3	0	0	0	0	0	0	0	0	0
CO 3	3	3	1	3	3	1	0	0	0	0	0	0	2	0
CO 4	3	3	0	3	0	0	0	0	0	0	0	0	1	0
CO 5	3	3	2	3	3	1	0	0	0	0	0	0	2	0

TEXTBOOKS:

T1. Signals, Systems & Communications-B. P. Lathi, B S Publications,2003.

T2. Signals and Systems-A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI,2ndEdn,1997

REFERENCEBOOKS:

R1. Principles of Linear Systems and Signals–BP Lathi, Oxford University Press,2015

R2. Signals & Systems-Simon Haykin and Van Veen, Wiley,2ndEdition,2007

ELECTRONIC DEVICES AND CIRCUITS

Subject Code: UGEC3T0223	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites:

- Basic Electrical & Electronics Engineering
- Network Analysis.

Course Objectives:

- To learn and understand the basic concepts of semiconductor physics.
- Study the physical phenomena such as conduction, transport mechanism and electrical characteristics of different diodes.
- To learn and understand the application of diodes as rectifiers with their operation and characteristics with and without filters are discussed.
- Acquire knowledge about the principle of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics.
- To learn and understand the purpose of transistor biasing and its significance.
- Small signal equivalent circuit analysis of BJT and FET transistor amplifiers and compare different configurations.

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

- **CO1.** Apply the basic concepts of semiconductor physics.
- **CO2.** Analyze the V-I Characteristics of P-N junction diode under forward and reverse bias conditions.
- **CO3.** Analyze the construction, working principle of Semiconductor Devices and Diode Circuits.
- **CO4.** Apply various biasing techniques for BJT and FET and stabilization concepts with necessary expressions
- **CO5.** Apply small signal low frequency transistor amplifier circuits using BJT and FET in different configurations

Syllabus

UNIT I **(12Hours)**

Review of Semiconductor Physics: Mobility and Conductivity, Intrinsic and extrinsic semiconductors, Hall effect, continuity equation, law of junction, Fermi Dirac function, Fermi level in intrinsic and extrinsic Semiconductors.

Junction Diode Characteristics : energy band diagram of PN junction Diode, Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in p-n junction Diode, Diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance.

UNIT II **(12Hours)**

Special Semiconductor Devices: Zener Diode, Breakdown mechanisms, Zener diode applications, Varactor Diode, LED, Photodiode, Tunnel Diode, UJT, PNPN Diode, SCR, Construction, operation and V-I characteristics.

Diode Circuits: The Diode as a circuit element, The Load-Line concept, The Piecewise Linear Diode model, Clipping (limiting) circuits, Clipping at Two Independent Levels, Peak Detector, Clamping circuits, Comparators, Sampling Gate, Basic Rectifier setup, half wave rectifier, full wave rectifier, bridge rectifier, derivations of characteristics of rectifiers, Filters, Inductor filter, Capacitor filter, π-section Filter, comparison of various filter circuits in terms of ripple factors.

UNIT III **(12Hours)**

Transistor Characteristics: Junction transistor, transistor current components, transistor equation in CB configuration, transistor as an amplifier, and characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through, Photo transistor, typical transistor junction voltage values.

Transistor Biasing and Thermal Stabilization : Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in VBE, Ic, and β, Stability factors, (S,S',S''), Bias compensation, Thermal runaway, Thermal stability.

UNIT IV **(10Hours)**

Small Signal Low Frequency Transistor Amplifier Models BJT: Two port network, Transistor hybrid model, determination of h-parameters, conversion of h-parameters, generalized analysis of transistor amplifier model using h-parameters, Analysis of CB, CE and CC amplifiers using exact and approximate analysis, Comparison of transistor amplifiers.

UNIT V **(12Hours)**

FET: FET types, JFET operation, characteristics, small signal model of JFET. MOSFET: MOSFET Structure, Operation of MOSFET: operation in triode region, operation in saturation region, MOSFET as a variable resistor, derivation of V-I characteristics of MOSFET, Channel length modulation, MOS transconductance, MOS device models: MOS small signal model, PMOS Transistor, CMOS Technology, Comparison of Bipolar and MOS devices. CMOS amplifiers: General Considerations, Common Source Stage, Common Gate Stage, Source Follower, comparison of FET amplifiers.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO1	3	3	0	0	0	0	0	0	0	0	0	0	2	2
CO2	3	3	0	0	0	0	0	0	0	0	0	0	0	0
CO3	3	3	2	0	0	0	0	0	0	0	0	0	2	0
CO4	3	3	3	0	0	0	0	0	0	0	0	0	0	1
CO5	3	3	3	0	0	0	0	0	0	0	0	0	0	2

TEXT BOOKS:

T1. Millman's Electronic Devices and Circuits- J. Millman, C. C. Halkias and Satyabrata Jit, Mc-Graw Hill Education, 4th edition, 2015.

T2. Fundamentals of Microelectronics-Behzad Razavi, Wiley, 3rd edition, 2021.

REFERENCE BOOKS

R1. Electronics devices & circuit theory- Robert L.Boylestad and Loui Nashelsky, Pearson,11th edition, 2015.

R2. Electronic Devices and Circuits- S. Salivahanan, N. Suresh Kumar, Mc-Graw Hill, 5th edition, 2022.

R3. Millman's Integrated Electronics-J. Millman, C. Halkias, and Ch. D. Parikh, Mc-Graw Hill Education, 2nd Edition, 2009.

SWITCHING THEORY AND LOGIC DESIGN

Subject Code: UGEC3T0323	**L**	**T**	**P**	**C**
II Year / I Semester	**3**	**0**	**0**	**3**

Prerequisites:

- Basic Electrical & Electronics Engineering

Course Objectives: This course helps students to acquire basic knowledge on number systems, logic gates, gate level minimization, combinational and sequential logic circuits, registers and counters and PLAs.

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

CO1. Make use of number systems for computer arithmetic.
CO2. Apply Boolean Algebra principles to simplify the Boolean expressions.
CO3. Design and analyze various Combinational Circuits and PLD's.
CO4. Design and analyze the sequential circuits.

Syllabus

UNIT I **(8Hours)**

REVIEW OF NUMBER SYSTEMS & CODES: Representation of numbers of different radix, conversation from one radix to another radix, r- 1's compliments and r's compliments of signed members. Gray code,4-bit codes; BCD, Excess-3, 2421, 8421 code etc. Error detection & correction codes: parity checking, even parity, odd parity, Hamming code.

BOOLEAN THEOREMS AND LOGIC OPERATIONS: Boolean theorems, principle of complementation & duality, De-morgan theorems. Logic operations; Basic logic operations - NOT, OR, AND, Universal Logic operations, EX-OR, EX- NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations, Realization of three level logic circuits.

UNIT II **(8Hours)**

MINIMIZATION TECHNIQUES: Minimization and realization of switching functions using Boolean theorems, K-Map (up to6 variables)and tabular method(Quine-mccluskey method) with only four variables and single function.

COMBINATIONAL LOGIC CIRCUITS DESIGN: Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4- bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a- head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams.

UNIT III **(12Hours)**

COMBINATIONAL LOGIC CIRCUITS DESIGN USING MSI &LSI : Design of encoder ,decoder, multiplexer and de-multiplexers, Implementation of higher order circuits using lower order circuits . Realization of Boolean functions using decoders and multiplexers. Design of Priority encoder, 4-bit digital comparator and seven segment decoders.

INTRODUCTION OF PLD's: PLDs: PROM,PAL, PLA -Basics structures, realization of Boolean functions, Programming table.

UNIT IV **(8 Hours)**

SEQUENTIAL CIRCUITS I: Classification of sequential circuits (synchronous and asynchronous), operation of NAND & NOR latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip- flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip- flop. Design of 5ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi- directional shift register, universal shift, register.

Study the following relevant ICs and their relevant functions 7474,7475,7476,7490,7493,74121.

UNIT V **(8 Hours)**

SEQUENTIAL CIRCUITS II: Finite state machine; state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa. Realization of sequence generator, Design of Clocked Sequential Circuit to detect the given sequence (with overlapping or without overlapping).

Mapping of COs to POs:

POs/ COs	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
CO1	3	3	2	0	0	0	0	0	0	0	0	0	1	1
CO2	3	3	2	0	0	0	0	0	0	0	0	0	2	2
CO3	3	3	2	0	0	0	0	0	0	0	0	0	2	2
CO4	3	3	3	0	0	0	0	0	0	0	0	0	2	2

TEXT BOOKS:

T1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K.Jha 3rd Edition, Cambridge University Press,2009.

T2. Digital Design by M.Morris Mano, Michael D Ciletti,4th edition PHI publication, 2008.

REFERENCE BOOKS:

R1. Switching Theory and Logic Design by A. AnandKumar,PHI Learning pvt ltd, 2016.

R2. Digital logic applications and design by John M Yarbough, Cengage learning, 2006.

R3. Switching theory and logic design by Hill and Peterson, Mc-Graw Hill TMH edition, 2012

ELECTRONIC DEVICES AND CIRCUITS LAB

Subject Code:UGEC3P0423	**L**	**T**	**P**	**C**
II Year/I Semester	**0**	**0**	**3**	**1.5**

Course Objectives

- Gain a comprehensive understanding of the basic electronic components such as diodes, transistors (BJT and FET), and SCRs.
- Study the operation, characteristics, and applications of these components in various circuits including clippers, clampers, rectifiers, and amplifiers.
- Develop skills to design and construct various electronic circuits, including rectifiers, amplifiers, and oscillators.
- Learn to implement biasing techniques and analyze the stability and performance of different transistor configurations.

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

CO1. Demonstrate the usage of CRO and applications of Diodes.
CO2. Analyze the various Characteristics of BJT and FET under different Biasing Conditions.
CO3. Analyze the characteristics of UJT and SCR
CO4. Analyze the frequency response of the BJT and FET as an amplifier.

EXPERIMENTS (Minimum of Ten)

1. CRO Operation and its Measurements
2. Clipper circuit using diode
3. Clamping circuit using diode
4. Rectifiers (without and with c-filter) Part A: Half-wave Rectifier Part B
5. Full-wave Rectifier
6. BJT Characteristics (CE Configuration) Part A:Input Characteristics
   Part B: Output Characteristics
7. FET Characteristics(CS Configuration) Part A: Drain CharacteristicsPart B:TransferCharacteristics
8. SCR Characteristics
9. UJT Characteristics
10. Transistor Biasing
11. BJT-CE Amplifier

12. Emitter Follower-CC Amplifier
13. FET-CS Amplifier

Mapping of Cos to POs

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	0	0	0	0	0	0	3	2	0	0	0	0
CO2	3	3	3	0	0	0	0	0	3	3	0	0	2	2
CO3	3	3	3	0	0	0	0	0	3	3	0	0	1	2
CO4	3	3	3	0	0	0	0	0	3	3	0	0	2	2

SWITCHING THEORY AND LOGIC DESIGN LAB

Subject Code :UGEC3P0523	**L**	**T**	**P**	**C**
II Year/ I Semester	**0**	**0**	**3**	**1.5**

Prerequisites

- Switching Theory and Logic Design

Laboratory Objectives

- To design and realize basic digital combinational and sequential circuits.
- To verify the functionality of basic digital combinational and sequential circuits

Course Outcomes: Upon the completion of the course, the student will be able to:

CO1. Solve the Boolean algorithms using practical logic gates.
CO2. Demonstrate the truth table of various expressions and combinational circuits using logic gates.
CO3. Design and verify basic combinational logic circuits using Practical ICs.
CO4. Design and verify basic sequential logic circuits using Practical ICs.

List of Experiments

1) Verification of truth tables of the following Logic gates
   Two input (i) OR (ii) AND (iii) NOR (iv) NAND (v) Exclusive-OR (vi) Exclusive-NOR
2) Design a simple combinational circuit with four variables and obtain minimal SOP expression and verify the truth table using Digital Trainer Kit.
3) Verification of functional table of 3 to 8-line Decoder /De-multiplexer
4) 4 variable logic function verification using 8 to1 multiplexer.
5) Design full adder circuit and verify its functional table.
6) Verification of functional tables of (i) JK Edge triggered Flip–Flop (ii) JK Master Slave
7) Flip–Flop (iii) D Flip-Flop
8) Design a four-bit ring counter using D Flip–Flops/JK Flip Flop and verify output.
9) Design a four-bit Johnson's counter using D Flip-Flops/JK Flip Flops and verify output
10) Verify the operation of 4-bit Universal Shift Register for different Modes of operation.
11) Draw the circuit diagram of MOD-8 ripple counter and construct a circuit using T-Flip-Flops and Test It with a low frequency clock and sketch the output waveforms.
12) Design MOD–8 synchronous counter using T Flip-Flop and verify the result and sketch the output waveforms.
    (a) Draw the circuit diagram of a single bit comparator and test the output
    (b) Construct 7 Segment Display Circuit Using Decoder and7 Segment LED and test it.

Additional Experiments:

1) Design BCD Adder Circuit and Test the Same using Relevant IC
2) Design Excess-3 to 9- Complement convertor using only four Full Adders and test the Circuit.
3) Design an Experimental model to demonstrate the operation of 74154 De-Multiplexer using LEDs for outputs.
4) Design of any combinational circuit using Hardware Description Language
5) Design of any sequential circuit using Hardware Description Language

Mapping of COs to POs

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO1	3	3	2	0	0	0	0	0	3	3	0	0	0	0
CO2	3	2	3	0	0	0	0	0	3	3	0	0	1	1
CO3	3	3	2	0	0	0	0	0	3	3	0	0	2	3
CO4	3	3	2	0	0	0	0	0	3	3	0	0	2	3

DATA STRUCTURES USING PYTHON

Subject Code:UGEC3K0623	**L**	**T**	**P**	**C**
II Year/I Semester	**0**	**1**	**2**	**2**

Course Objectives : The course should enable the students to:

- Understand various data representation techniques in the real world.
- Implement linear and non-linear data structures.
- Analyse various algorithms based on their time and space complexity.
- Develop real-time applications using suitable data structure.
- Identify suitable data structure to solve various computing problems.

Course Outcomes : The student will have the ability to:

CO1. Understand the concept of data structures, python and apply algorithm for solving problems like Sorting, searching, insertion and deletion of data.

CO2. Understand linear data structures for processing of ordered or unordered data.

CO3. Explore various operations on dynamic data structures like single linked list, circular linked list, and doubly linked list.

CO4. Explore the concept of nonlinear data structures such as trees and graphs.

CO5. Understand the binary search trees, hash function, and concepts of collision and its resolution methods.

List of Experiments

1. Write a Python program for class, Flower, that has three instance variables of type str, int, and float that respectively represent the name of the flower, its number of petals, and its price. Your class must include a constructor method that initializes each variable to an appropriate value, and your class should include methods for setting the value of each type, and retrieving the value of each type.
2. Develop an inheritance hierarchy based upon a Polygon class that has abstract methods area( ) and perimeter( ). Implement classes Triangle, Quadrilateral, Pentagon, that extend this base class, with the obvious meanings for the area( ) and perimeter( ) methods. Write a simple program that allows users to create polygons of the various types and input their geometric dimensions, and the program then outputs their area and perimeter.
3. Write a python program to implement Method Overloading and Method Overriding.
4. Write a Python program to illustrate the following comprehensions:
   a) List Comprehensions b) Dictionary Comprehensions c) Set Comprehensions

d) Generator Comprehensions

5. Write a Python program to generate the combinations of n distinct objects taken from the elements of a given list. Example: Original list: [1, 2, 3, 4, 5, 6, 7, 8, 9] Combinations of 2 distinct objects: [1, 2] [1, 3] [1, 4] [1, 5] .... [7, 8] [7, 9] [8, 9].
6. Write a program for Linear Search and Binary search.
7. Write a program to implement Bubble Sort and Selection Sort.
8. Write a program to implement Merge sort and Quick sort.
9. Write a program to implement Stacks and Queues.
10. Write a program to implement Singly Linked List.
11. Write a program to implement Doubly Linked list.
12. Write a program to implement Binary Search Tree.

Mapping of COs to POs

POs	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
CO1	3	0	0	0	3	0	0	0	3	3	0	0	0	0
CO2	3	0	0	0	3	0	0	0	3	3	0	0	0	0
CO3	3	0	3	0	3	0	0	0	3	3	0	3	0	0
CO4	3	0	0	0	3	0	0	0	3	3	0	0	0	0
CO5	3	0	3	0	3	0	0	0	3	3	0	0	0	0

ENVIRONMENTAL SCIENCE
(AUDIT COURSE)

Subject Code : UGBS3A0723	**L**	**T**	**P**	**C**
II Year / I Semester	**2**	**0**	**0**	**0**

Course Objectives:

- To make the students aware of the environment.
- To understand the importance of protecting natural resources, eco systems for future generations and pollution causes due to the day-to-day activities of human life.
- To save the earth from the inventions of engineers.

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

CO1. Grasp the multi-disciplinary nature of environmental studies and various renewable and non-renewable resources.

CO2. Understand flow and bio-geo-chemical cycles and ecological pyramids.

CO3. Understand various causes of pollution and solid waste management and related preventive measures.

CO4. Understand rainwater harvesting, watershed management, ozone layer depletion, and wasteland reclamation.

CO5. Illustrate the causes of population explosion, value education, and welfare programs.

Syllabus

UNIT I **(9 Hours)**

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 groundwater – Floods, drought, conflicts over water, dams – benefits and problems – **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies – **Food resources**: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT II **(8 Hours)**

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following eco system:

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

Biodiversity and Its Conservation: Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, 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 wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT III (12Hours)

Environmental Pollution: Definition, Cause, effects and control measures of:

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, earthquake, cyclone and landslides.

UNIT IV (8 Hours)

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. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V (8 Hours)

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Mapping of COs to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	2	3	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	3	-	-	-	-	-	-	-
CO3	-	-	3	-	3	3	3	-	-	-	-	2	-	-
CO4	-	-	-	-	2	3	3	-	-	-	-	2	-	-
CO5	-	-	-	-	-	3	3	-	-	-	-	2	-	-

TEXT BOOKS

T1. Erach Bharucha, Text book of Environmental Studies for Undergraduate Courses, Universities Press (India) Private Limited,2019.

T2. Palani swamy, Environmental Studies, 2/e, Pearson education, 2014.

T3. S.AzeemUnnisa, Environmental Studies, Academic Publishing Company, 2021.

T4. K.RaghavanNambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", SciTech Publications (India), Pvt. Ltd, 2010.

REFERENCE BOOKS

R1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.

R2. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014.

R3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.

R4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private Limited, 1988.

R5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.

R6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

II YEAR
II SEMESTER

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Subject Code: UGMB4T0123	**L**	**T**	**P**	**C**
II Year/II Semester	**2**	**0**	**0**	**2**

Course Objectives: To enable the student to understand and appreciate, with particular insight, the importance of certain basic issues governing the business operations namely; demand and supply, production function, cost analysis, markets, forms of business organizations, capital budgeting, and financial accounting and financial analysis.

Course Outcomes:

- **CO1.** Define the concepts related to Managerial Economics, financial management.
- **CO2.** Understand the fundamentalsof economics viz., Demand, Production, cost, revenue, and markets
- **CO3.** Apply the Concept of Production cost and revenues for effective Business decision
- **CO4.** Analyze how to invest their capital and maximize returns Evaluate the capital budgeting techniques
- **CO5.** Develop the accounting statements and evaluate the financial performance of business entity.

Syllabus

UNIT-I

Managerial Economics: Introduction – Nature, meaning, significance, functions, andadvantages. 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: Introduction – Nature, meaning, significance, functions, and advantages. Production Function– Least-cost combination– Short run and long run Production Function- Isoquants and Iso-costs, MRTS -Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-EvenAnalysis (BEA) -Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

UNIT-III

Business Organizations and Markets: Introduction–Nature, meaning, significance, functions and advantages. 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: Introduction – Nature, meaning, significance, functions and advantages. 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: Introduction – Nature, meaning,significance, functions, and advantages. Concepts and Conventions-Double-Entry Book Keeping, Journal, Ledger, Trial Balance-Final Accounts (Trading Account, Profit and Loss Account, and Balance Sheet with simple adjustments). Financial Analysis- Analysis and Interpretation of Liquidity Ratios, Activity Ratios, Capital Structure Ratios and Profitability.

Mapping of Cos to POs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	-	-	-	2
CO2	-	-	-	-	-	-	-	-	-	-	-	1
CO3	-	-	-	-	-	-	-	-	-	-	-	1
CO4	-	-	-	-	-	-	-	-	-	2	3	2
CO5	-	-	-	-	-	-	-	-	-	3	3	2

Textbooks

T1. Varshney&Maheswari:ManagerialEconomics,SultanChand,2013.

Reference Books

R1. Managerial Economics: Principles And Worldwide Applications, 9E (Adaptation) by Dominick Salvatore and Siddhartha Rastogi.

R2. Managerial Economics :Principles and World wide Applications by Dominick Salvatore.

LINEAR CONTROL SYSTEMS

Subject Code : UGEC4T0123	**L**	**T**	**P**	**C**
II Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisites

- Linear Algebra & Calculus
- Differential Equations and Vector Calculus
- Engineering Physics
- Network Analysis

Course Objectives: The course is deals with

- To introduce the concepts of open loop and closed loop systems, mathematical models of mechanical and electrical systems, and concepts of feedback.
- To study the characteristics of the given system in terms of the transfer function and introducing various approaches to reduce the overall system for necessary analysis.
- To develop the acquaintance in analyzing the system response in time domain and frequency domain in terms of various performance indices.
- To analyze the system in terms of absolute stability and relative stability by different approaches.
- To design different control systems for different applications as per given specifications.
- To introduce the concepts of state variable analysis, design and also the concepts of controllability and observability.

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

CO1. Develop the transfer functions for open loop and closed loop control systems.

CO2. Model the time response of control systems.

CO3. Apply root locus technique to analyze & design control systems.

CO4. Examine the stability of control systems using frequency domain techniques.

CO5. Model the control systems using state space representation.

SYLLABUS

UNIT – I **(12 hours)**

INTRODUCTION: Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems, Feed-back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions- Translational and Rotational mechanical systems.

UNIT -II **(10 hours)**

TRANSFER FUNCTION REPRESENTATION: Transfer Function of DC Servo motor - AC Servo motor- Synchro-transmitter and Receiver, Block diagram representation of systems considering electrical systems as examples - Block Diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.

TIME RESPONSE ANALYSIS: Standard test signals - 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.

UNIT – III **(10 hours)**

STABILITY ANALYSIS IN S-DOMAIN: The concept of stability – Routh's stability Criterion – qualitative stability and conditional stability – limitations of Routh's stability.

ROOT LOCUS TECHNIQUE: 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 **(12 hours)**

FREQUENCY RESPONSE ANALYSIS: Introduction, Correlation between time and frequency response, Polar Plot, Bode Plot, Nyquist Stability Criterion.

UNIT – V **(8 hours)**

STATE SPACE REPRESENTATION: Compensation techniques – Lag, Lead, Lead-Lag Controllers design infrequency Domain, PID Controllers, State Space Analysis of Continuous Systems Concepts of state, state variables and state model, Derivation of state models from block diagrams, Diagonalization- Solving the Time invariant State Equations- State Transition Matrix and its Properties. Concepts of Controllability and Observability.

Mapping of COs to POs

POs	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
CO1	3	3	1	1	0	0	0	0	0	0	0	0	0	0
CO2	3	2	3	3	0	0	0	0	0	0	0	0	0	0
CO3	3	2	3	3	0	0	0	0	0	0	0	0	0	0
CO4	3	2	3	3	0	0	0	0	0	0	0	0	0	0
CO5	3	2	0	1	0	0	0	0	0	0	0	0	0	0

Text Books

T1. Automatic Control Systems 8th edition– by B.C.Kuo – Johnwiley and son's, 2003.

T2. Control Systems Engineering –by I. J.Nagrath and M.Gopal, New Age International (P) Limited, Publishers, 2nd edition, 2007.

Reference Books

R1. Control Systems by A.Nagoorkani, RB Apublications, 3rd edition, 2017.

R2. Control Systems by A.Anandkumar, PHI, 2nd Edition, 2014.

ELECTROMAGNETIC WAVES AND TRANSMISSION LINES

Subject Code : UGEC4T0223	**L**	**T**	**P**	**C**
II Year/ II Semester	**3**	**0**	**0**	**3**

Prerequisites

- Linear Algebra & Calculus
- Differential Equations and Vector Calculus
- Engineering Physics

Course Objectives: The main objectives of this course are to:

- Understand the fundamentals of electric fields, coulomb's law and gauss law
- Familiar with of Biot-Savart Law, Ampere's Circuital Law and Maxwell equations
- Aware of electromagnetic wave propagation in dielectric and conducting media
- Study the equivalent circuit of transmission lines and parameters of the transmissionlines
- Learn the working of smith chart and its usage in the calculation of transmission lineparameters

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

CO1. Determine electric field intensity using coulomb's law and Gauss law.

CO2. Determine magnetic field intensity using Biot-Savarts Law and Ampere's CircuitalLaw.

CO3. Analyze the electromagnetic wave propagation in dielectric and conducting media.

CO4. Examine the primary and secondary constants of different types of transmission lines.

CO5. Derive the expressions for input impedance, reflection coefficient, and VSWR oftransmission lines and calculate these parameters using smith chart.

Syllabus

UNIT I **(12Hours)**

Review of Co-ordinate Systems, Electrostatics: Coulomb's Law, Electric Field Intensity, Electric Flux Density, Gauss 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 **(16Hours)**

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 **(14Hours)**

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 Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance, Poynting Vector and Poynting Theorem, Illustrative Problems.

UNIT IV **(8 Hours)**

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, distortion less lines, Illustrative Problems.

UNIT V **(8 Hours)**

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.

Mapping of COs to Pos

POs	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
CO1	3	3	2	3	0	0	0	0	0	0	0	0	2	0
CO2	3	3	3	2	0	0	0	0	0	0	0	0	2	0
CO3	3	3	3	3	0	0	0	0	0	0	0	0	2	0
CO4	3	3	2	0	0	0	0	0	0	0	0	0	2	0
CO5	3	3	2	0	0	0	0	0	0	0	0	0	2	0

TEXT BOOKS:

T1. Elements of Electromagnetic – Matthew N. O. Sadiku, Oxford University Press, 7th edition, 2018.

T2. Electromagnetic Waves and Radiating Systems – E.C. Jordan and K.G. Balmain, PHI, 2nd Edition, 2008.

REFERENCE BOOKS:

R1. Engineering Electromagnetics – William H. Hayt, John A. Buck, Jaleel M. Akhtar, TMH, 9th edition, 2020.

R2. Electromagnetic Field Theory and Transmission Lines –G. S. N. Raju, Pearson Education 2006

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ELECTRONIC CIRCUIT ANALYSIS

Subject Code:UGEC4T0323	**L**	**T**	**P**	**C**
II Year / II Semester	**3**	**0**	**0**	**3**

Prerequisites:

- Electronic Devices and Circuits
- Network Analysis.

Course Objectives:

- To learn hybrid- π parameters a thigh frequency and compare with low frequency parameters.
- Learn and understand the purpose of cascading of single stage amplifiers and derive the overall voltage gain.
- Analyze the effect of negative feedback on amplifier characteristics and derive the characteristics.
- Learn and understand the basic principle of oscillator circuits and perform the analysis of different oscillator circuits.
- Compare and analyze different Power amplifiers like Class A, Class B, Class C, Class AB and other types of amplifiers.
- Analyze different types of tuned amplifier circuits.

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

CO1. Analyze the small signal high frequency amplifier using BJT and FET.

CO2. Analyze the multistage amplifiers using BJT, FET, Differential amplifier (BJT) and apply feedback concepts to amplifier circuits.

CO3. Derive the expressions for frequency of oscillation and condition for oscillation of RC and LC oscillators

CO4. Analyze the performance of the power and tuned amplifiers.

Syllabus

UNIT I **(12Hours)**

Small Signal High Frequency Transistor Amplifier models: BJT: Transistor at high frequencies, Hybrid- π common emitter transistor model, Hybrid πconductance, Hybrid π capacitances, validity of hybrid π model, determination of high- frequency parameters in terms of low-frequency parameters , CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product.

FET: Analysis of common Source and common drain Amplifier circuits at high frequencies.

UNIT II **(10Hours)**

Multistage Amplifiers: Classification of amplifiers, methods of coupling, cascaded transistor amplifier and its analysis, analysis of two stage RC coupled amplifier, high input resistance transistor amplifier circuits and their analysis-Darlington pair amplifier, Cascode amplifier, Boot-strap emitter follower, Differential amplifier using BJT.

UNIT III **(10Hours)**

Feedback Amplifiers: Feedback principle and concept, types of feedback, classification of amplifiers, feedback topologies, Characteristics of negative feedback amplifiers, Generalized analysis of feedback amplifiers, Performance comparison of feedback amplifiers, Method of analysis of feedback amplifiers.

UNIT IV **(10Hours)**

Oscillators: Oscillator principle, condition for oscillations, types of oscillators, RC-phase shift and Wien bridge oscillators with BJT and FET and their analysis, Generalized analysis of LC Oscillators, Hartley and Colpitt's oscillators using BJT, Frequency and amplitude stability of oscillators.

UNIT V **(12Hours)**

Power Amplifiers: Classification of amplifiers(A to H), Class A power Amplifiers, Class B Push-pull amplifiers, Complementary symmetry push pull amplifier, Class AB power amplifier, Class-C power amplifier, Thermal stability and Heat sinks.

Tuned Amplifiers: Introduction, Q-Factor, small signal tuned amplifier, capacitance single tuned amplifier, double tuned amplifiers, , staggered tuned amplifiers

Mapping of COs to POs

POs	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
CO1	3	3	3	0	0	0	0	0	0	0	0	0	1	1
CO2	3	3	3	0	0	0	0	0	0	0	0	0	1	1
CO3	3	3	3	0	0	0	0	0	0	0	0	0	0	0
CO4	3	3	3	2	0	0	0	0	0	0	0	0	0	0

TEXT BOOKS:

T1. Integrated Electronics- J.Millman and C.C.Halkias, Tata McGraw-Hill, 1972.

T2. Electronic Devices and CircuitsTheory –Robert L.Boylestad and Louis Nashelsky, Pearson/PrenticeHall, TenthEdition, 2009.

Reference Books:

R1. Micro electronic Circuits-Sedra A.S. and K.C. Smith, Oxford University Press, Sixth Edition, 2011.

R2. Electronic Circuit Analysis and Design –Donald A.Neaman, McGrawHill, 2010.

ANALOG COMMUNICATIONS

Subject Code : UGEC4T0423	**L**	**T**	**P**	**C**
II Year/ II Semester	**3**	**0**	**0**	**3**

PREREQUISITES

- Signals and Systems
- Probability Theory and Stochastic Processes

COURSE OBJECTIVES: This course aims to introduce to the students about

- The basic principles and techniques used in Analog communications.
- Classification and design considerations of Radio Transmitters and Receivers

COURSE OUTCOMES: At the end of the Course, Student will be able to:

CO1. Analyze the different types of Amplitude Modulation and Demodulation techniques.

CO2. Analyze the concepts of generation and detection of Angle Modulated signals.

CO3. Interpret the Radio Transmitters and Receivers with different sections.

CO4. Illustrate the noise performance in Analog Modulation techniques and also the concepts of Pulse Analog Modulation and Demodulation techniques.

Syllabus

Unit – I

Amplitude Modulation: Introduction to Fourier transform, Introduction to communication system, Need for modulation, Frequency Division Multiplexing, Amplitude Modulation, Time domain and Frequency domain descriptions, Single tone modulation, Power relations in AM waves, Generation of AM waves: Square law Modulator, Switching modulator, Detection of AM Waves: Square law detector, Envelope detector, Related problems.

Unit – II

DSB & SSB Modulation: Double sideband suppressed carrier modulator: Time domain and frequency domain description, Generation of DSBSC Waves: Balanced Modulator, Ring Modulator, Detection of DSBSC Waves: Coherent detection, Quadrature Null Effect, COSTAS Loop, Squaring Loop.

Single sideband suppressed carrier modulator: Time domain and Frequency domain description, Generation of SSBSC Waves: Frequency discrimination method, Phase discrimination method, Demodulation of SSB Waves: Coherent Detection.

Vestigial sideband modulation: Time domain description, Frequency domain description, Generation of VSB Modulated wave, Envelope detection of a VSB Wave

pulse Carrier, Comparison of different AM Techniques, Applications of different AM Systems, Related problems.

Unit – III

Angle Modulation: Introduction, Basic concept of phase modulation, Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave, Generation of FM Waves: Direct Method, Indirect Method, Detection of FM Waves: Balanced Frequency discriminator, Zero crossing detector, Phase locked loop, Comparison of FM & AM, Related problems.

Unit – IV

Radio Transmitters: Classification of Transmitters, AM Transmitter, Effect of feedback on performance of AM Transmitter, FM Transmitter: Variable reactance type and Phase modulated FM Transmitter, Frequency stability in FM Transmitter.

Radio Receivers: Receiver Types: Tuned radio frequency receiver, Super heterodyne receiver, RF section and Characteristics, Frequency changing and tracking, Intermediate frequency, AGC, FM Receiver, Amplitude limiting, Comparison of FM & AM Receivers, Communication Receivers, Extension of super heterodyne principle and additional circuits.

Unit – V

Noise: Review of noise and noise sources, Noise figure, Noise in Analog communication Systems: Noise in DSB & SSB Systems, Noise in AM System and Noise in Angle Modulation

Systems, Threshold effect in Angle Modulation System, Pre-emphasis & De-emphasis.

Pulse Analog Modulation: Types of Pulse modulation, PAM (Single polarity, double polarity), PWM: Generation & Detection of PWM, PPM: Generation and Detection of PPM, Time Division Multiplexing, TDM Vs FDM.

Mapping of COs to POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	0	0	0	0	0	0	0	0	0	0	0
CO2	3	3	3	0	0	0	0	0	0	0	0	0	0	0
CO3	3	3	2	2	0	0	0	0	0	0	0	0	0	0
CO4	3	3	2	2	0	0	0	0	0	0	0	0	0	0

Text Books

T1. Communication Systems, Simon Haykin, Michael Moher, Wiley, 5th Edition, 2009.

T2. Principles of Communication Systems, H Taub, D L Schilling, Gautam Sahe, TMH, 4th Edition,2017.

Reference Books

R1. Electronics & Communication Systems, George Kennedy, Bernard Davis, S R M Prasanna,TMH, 6th Edition, 2017.

R2. Communication Systems (Analog and Digital), Dr. Sanjay Sharma, Katson Books, 7th Reprint Edition, 2018.

Web Links:

1. http://nptel.ac.in/courses/117102059/ Prof. Surendra Prasad.
2. https://ict.iitk.ac.in/wp-content/uploads/EE320A-Principles-Of-Communication-CommunicationSystems-4ed-Haykin.pdf.
3. https://www.scribd.com/document/266137872/sanjay-sharma-pdf.
4. http://bayanbox.ir/view/91440908351988908 6/Book-Modern-Digital-And-AnalogCommunication-Systems-4th-edition-by-Lathi.pdf.
5 https://soaneemrana.org/onewebmedia/ELECTRONICS%20COMMUNICATION%20SYSTEM%20 BY%20GEORGE%20KENNEDY.pdf

SIGNALS AND SYSTEMS LAB

Subject Code : UGEC4P0523	**L**	**T**	**P**	**C**
II Year-II Semester	**0**	**0**	**3**	**1.5**

Course Outcomes : Upon completion of the Laboratory, students will be able to

- **CO1.** Plot different classes of continuous time and discrete time signals and perform operations on it using MATLAB.
- **CO2.** Analyze response of an LTI system for different inputs.
- **CO3.** Examine the response of different transform techniques for Continuous Time signals.
- **CO4.** Analyze the response of transform techniques for Discrete Time sequences.

List of Experiments

I. Generation of Basic Signals (Analog and Discrete)
   1. Unit step
   2. Unit impulse
   3. Unit Ramp
   4. Sinusoidal
   5. Signum

II. Operations on signals
   1. Addition & Subtraction
   2. Multiplication & Division
   3. Maximum & minimum

III. Energy and power of signals, even and odd signals

IV. Transformation of the independent variable
   1. Shifting (Delay & Advance)
   2. Reversing
   3. Scaling

V. Convolution & Deconvolution

VI. Correlation

VI. Fourier Series Representation

VIII. Fourier Transform and Analysis of Fourier Spectrum

IX. Laplace Transforms

X. Z-Transforms

Mapping of COs to Pos

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2
CO 1	3	1	2	0	3	0	0	0	3	3	0	0	0	0
CO 2	3	1	3	0	3	0	0	0	3	3	0	0	1	0
CO 3	3	2	3	0	3	0	0	0	3	3	0	0	1	0
CO 4	3	2	3	0	3	0	0	0	3	3	0	0	1	0

ELECTRONIC CIRCUIT ANALYSIS LAB

Subject Code : UGEC4P0623	**L**	**T**	**P**	**C**
II Year-II Semester	**0**	**0**	**3**	**1.5**

Course Objectives

- Develop a deep understanding of various amplifier configurations such as voltage-series feedback, current-shunt feedback, Darlington pair, and class A, B, and complementary symmetry class B amplifiers.
- Learn to design and analyze different types of oscillators including RC phase shift, Wien bridge, Hartley, and Colpitt's oscillators.
- Explore the principles of feedback in amplifiers and its impact on gain stability, bandwidth, and distortion.
- Design and implement circuits with both positive and negative feedback, and analyze their effects on overall performance.

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

- **CO1.** Analyze different amplifier configurations' gain and frequency response.
- **CO2.** Design and evaluate various oscillator circuits for stable signal generation.
- **CO3.** Implement and measure feedback effects on amplifier performance and stability.
- **CO4.** Compare theoretical calculations with experimental results and troubleshoot discrepancies.

EXPERIMENTS (Minimum of Ten)

1. Determination of Ft of a given transistor.
2. Voltage-Series Feedback Amplifier
3. Current-Shunt Feedback Amplifier
4. RC Phase Shift/Wien Bridge Oscillator
5. Hartley/Colpitt's Oscillator
6. Two Stage RC Coupled Amplifier
7. Darlington Pair Amplifier
8. Boots trapped Emitter Follower
9. Class A Series-fed Power Amplifier
10. Transformer-coupled Class A Power Amplifier
11. Class B Push-Pull Power Amplifier

12. Complementary Symmetry Class B Push-Pull Power Amplifier
13. Single Tuned Voltage Amplifier
14. Double Tuned Voltage Amplifier

Mapping o f COs to POs

POs	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
CO1	3	3	3	0	0	0	0	0	3	3	0	0	0	2
CO2	3	3	3	0	0	0	0	0	3	3	0	0	0	2
CO3	3	3	3	0	0	0	0	0	3	3	0	0	0	2
CO4	3	3	3	0	0	0	0	0	3	3	0	0	0	0

SOFT SKILLS

Subject Code: UGMB4K0323	L	T	P	C
II Year/II Semester	0	1	2	2

Course Objectives

- To prepare to face global competition for employment and excellence in profession.
- To help the students understand and build interpersonal and interpersonal skills that will enable them to lead meaningful professional life.

Course Outcomes

CO1. Assimilate and understood the meaning and importance of soft skills and learn how to develop them.

CO2. Understand the significance of soft skills in the working Environment for professional excellence

CO3. Prepare to undergo the placement process with confidence and clarity

CO4. Ready to face any situation in life and equip themselves to handle them effectively.

CO5. Understand and learn the importance of etiquette in both professional and personal life.

Syllabus

UNIT–1: INTRODUCTION

Introduction- Emergence of life skills, Definition & Meaning, Importance& need, reasons for skill gap, Analysis--Soft Skills vs Hard skills, Linkage between industry and soft skills, Challenges, Personality Developments. Soft Skills, Soft Skills vs English – Improving Techniques.

UNIT–II: Intra-Personal:

Definition-Meaning – Importance-SWOT analysis, Johari windows - Goal Setting-quotient skills - Emotional Intelligence- Attitudinal skills - Right thinking- Problem Solving-Time management, stress management.

UNIT–III: Inter-Personal:

Definition – Meaning – Importance-Communications skills- Team Work, managerial skills -Negotiation skills- Leadership skills, corporate etiquettes.

UNIT–IV: VerbalSkills:

Definition and Meaning-Listening skills, need- types, advantages, Importance-Improving Tips for Listening, Speaking, need- types, advantages, Importance-

Improving Tips, Reading- Writing Skills, Report, Resume, statement of purpose, need- types, advantages, Importance-Improving Tips.

UNIT–V:Non-Verbal Skills & Interview skills

Definition and Meaning – Importance- Facial Expressions- Eye Contact – Proxemics- Haptics -Posture, cross cultural body language, body language in interview room, appearance and dress code – Kinetics- Para Language - tone, pitch, pause, neutralization of accent, use of appropriate language, Interview skills, interview methods and questions.

MappingofCOstoPOs:

POs/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	-	-	-	-	-	-	-	-	-	3	-	3
CO2	-	-	-	-	-	-	-	-	-	3	-	2
CO3	-	-	-	-	-	-	-	-	-	3	-	3
CO4	-	-	-	-	-	-	-	-	-	3	-	2
CO5	-	-	-	-	-	-	-	-	-	3	-	2

Text Books

T1. Sherfield,M.Robertatal,CornerstoneDevelopingSoftSkills,4/e,Pearson Publication, New Delhi, 2014.

T2. AlkaWadkar,LifeSkillsforSuccess,1/e,SagePublicationsIndiaPrivate Limited, 2016.

Reference Books

R1. Sambaiah.M.TechnicalEnglish,WileypublishersIndia.NewDelhi.2014.

R2. Gangadhar Joshi, From Campus to Corporate, SAGE TEXT.

R3. Alex.K,Soft Skills, 3rd ed. S.Chand Publication, NewDelhi,2014.

R4. Meenakshi Ramanand Sangita Sharma, Technical Communication : Principle and Practice, Oxford University Press, 2009.

R5. Shalini Varma, Body Language for Your Success Mantra, 4/e, S.Chand Publication, New Delhi, 2014.

R6. Stephen Covey, Seven Habits of Highly Effective People, JMD Book, 2013.

DESIGN THINKING & INNOVATION

Subject Code: UGME4P0623	**L**	**T**	**P**	**C**
II Year / II Semester	**1**	**0**	**2**	**2**

Course Objectives : The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

Course Outcomes:

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

CO1: Define the concepts related to design thinking.

CO2: Explain the fundamentals of Design Thinking and innovation.

CO3: Apply the design thinking techniques for solving problems in various sectors.

CO4: Analyze to work in a multidisciplinary environment.

CO5: Evaluate the value of creativity.

Syllabus

UNIT–I

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

UNIT–II

Design Thinking Process : 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 : 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 : 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 : 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.

Mapping of COs to POs:

POs/ COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	3	3	-	-	3	-	-	-	-	-	-	-	-
CO2	-	3	3	-	3	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	3	2	3	3	3	3	-	-
CO4	-	-	-	-	-	3	3	2	3	3	3	3	-	-
CO5	-	-	3	3	-	3	3	3	3	3	3	3	-	-

Text Books

T1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.

T2. Idris Mootee, Design Thinking for Strategic Innovation,1/e, Adams Media, 2014.

Reference Books

R1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.

R2. ShrrutinNShetty,DesigntheFuture,1/e,NortonPress,2018.

R3. William lidwell, Kritina holden, & Jillbutter, Universal principles of design, 2/e, Rock port Publishers, 2010.

R4. Ches brough. H, The era of open innovation, 2003.

OnlineLearningResources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Evaluation Guidelines:

- "Design Thinking & Innovation" course is conducted as a practical course.
- The course is evaluated for 100 marks out of which 50 marks are allotted forday-to-day work. Another 50 marks are allotted for the internal evaluation at the end of semester.

i) Day-to-day work:

- Student groups shall be formed, and assessments will be conducted after the completion of each unit. Each unit assessment will carry a weightage of 10 marks, culminating in a total of 50 marks over the course of 5 units.

Assessment methods shall include:

i. Power point presentations
ii. Charts
iii. Posters
iv. Prototypes

ii) Internal Evaluation:

- At the end of semester, students should present their idea and rubric for 50 marks is listed below.
    1. Understanding the problem : 10 marks
    2. Idea generation & creativity : 10 marks
    3. Prototype & Model making : 10 marks
    4. Presentation skills : 10 marks
    5. Practical application : 10 marks