GUJARAT TECHNOLOGICAL UNIVERSITY

INSTRUMENTATION & CONTROL ENGINEERING (17)
Bachelor of Engineering
Subject Code: 3131704
Semester – III
Subject Name: Digital Electronics

Type of course: Professional Core Course

Prerequisite: NA

Rationale: Understanding of principle, operation and analysis of digital electronics

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	BINARY SYSTEM: Digital computer and digital systems, Binary Number, Number base conversion Octal and Hexadecimal Number, complements, Binary Codes, Binary Storage and register, Binary Logic, Integrated Circuit	3
2	BOOLEAN ALGEBRA AND LOGIC GATES: Basic Definition, Axiomatic Definition of Boolean Algebra, Basic Theorem and Properties of Boolean Algebra, Minterms And Maxterms, Logic Operations, Digital Logic Gates, IC digital Logic Families	5
3	SIMPLIFICATION OF BOOLEAN FUNCIONS: Different types, K Map method, Product of sum Simplification, NAND or NOR implementation, Don't Care condition, Tabulation method	5
4	COMBINATIONAL LOGIC: Introduction, Design Procedure, adder, subtractor, Code Conversion, Universal Gate	5
5	COMBINATIONAL LOGIC WITH MSI AND LSI: Introduction, Binary Parallel Adder, Decimal Adder, The look ahead carry Adder, Excess-3 Adder, Binary Multipliers, Parity bit Generators/checkers, Magnitude Comparator, Encoder, Decoder, Multiplexer, De-multiplexer, Hazards and hazards free realization .	9
6	SEQUENTIAL LOGIC: Introduction, Flip-Flops, Triggering of Flip-Flops, Analysis of	10

	Clocked Sequential Circuits, State Reduction and Assignment, Flip-Flop Excitation Tables, Design Procedure, Design of Counters, Design with State Equations, The finite state model, Synthesis of synchronous sequential circuits, Serial Binary adder with Moore type FSM, The sequence Detector, Mealy type model, Moore type circuit.	
7	REGISTERS, COUNTERS AND THE MEMORY UNIT: Introduction, Registers, Shift Registers, Ripple Counters, Synchronous Counters, Timing Sequences, Memory Unit, RAM, ROM, EPROM, EEPROM, Flash Memory	**5**
8	REGISTERS TRANSFER LOGIC & MICRO OPERATION: Introduction, Inter-register Transfer, Arithmetic, logic and shift Micro- Operations, Conditional Control Statements, Fixed-Point Binary Data, overflow, Arithmetic Shifts, Decimal Data, Floating-Point Data, Instruction Codes, Design of Simple Computer.	**5**
9	LOGIC FAMILIES: Digital IC specification Terminology: Threshold voltage, Propagation Delay, Power dissipation, Fan-in, Fan-out, Voltage and current parameters, Noise margin, Operating Temperature, Speed power product. Transistor Transistor Logic: Two input TTL NAND gate, Totem pole output, Current sinking, Current sourcing, TTL loading and Fan-out. Open Collector gates: Wired AND operation, Tri state TTL, Buffer/Drivers.	**5**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
21	**21**	**14**	**7**	**7**	**7**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. M Morris Mano, "Digital Logic and Computer Design",Person, LPE, 4th ed., 2009

2. A. Anandkumar, "Fundamentals of Digital circuits", PHI, Second Edition.
3. Malvino& Leach, "Principle of Digital Electronics", MCGraw-Hill, 2nded, 1975
4. R.P.Jain, "Modern Digital Electronics", McGraw-Hill, 4th ed. 2010.
5. Boyce J. C., "Digital Logic: Operation and Analysis", Prentice Hall, 2nded., 1982

GUJARAT TECHNOLOGICAL UNIVERSITY

INSTRUMENTATION & CONTROL ENGINEERING (17)
Bachelor of Engineering
Subject Code: 3131704

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Apply knowledge of Boolean algebra and other minimization techniques for digital circuit design.	30
CO-2	Identify, formulate and solve a problem based on combinational and sequential circuits	40
CO-3	Select the appropriate hardware and software tools for combinational and sequential circuit design.	30

List of Experiments:

1. Verification of logic gates using digital ICs and configuring NAND and NOR gates as universal logic gates.
2. Implementation of Boolean Logic Functions using logic gates and combinational circuits, measure digital logic gates specifications such as propagation delay, noise margin, Fan-in and Fan-out
3. Design and implementation of Binary Half adder, full adder, half subtractor, full subtractor, Parallel adder.
4. Design and implementation of code converters.
5. Design and implementation of Encoder and Decoder.
6. Design and implement of Magnitude comparator.
7. Design and implementation of multiplexer and de-multiplexer.
8. Design and Implement JK-flip-flop, RS-flip-flop, D – flip-flop and T-flip-flop using digital Ics.
9. Design and implement universal shift registers using digital IC.
10. Design and implement Asynchronous and synchronous Counters.

Major Equipment: Digital Storage Oscilloscope (DSO), CROs, Multi-meters, Function generator, Bread board trainer, Logic gate ICs

List of Open Source Software/learning website:

http://nptel.iitm.ac.in, http://vlab.co.in/

GUJARAT TECHNOLOGICAL UNIVERSITY

INSTRUMENTATION & CONTROL ENGINEERING (17)
Bachelor of Engineering
Subject Code: 3131705
Semester – III
Subject Name: Dynamics of Linear Systems

Type of course: Basic Science

(Basic course for the foundation of signals and systems for control engineering.)

Prerequisite: Basic knowledge of integration, differentiation and complex numbers.

Rationale: This course will provide the students (i) understanding of the mathematical description of continuous and discrete time signals and systems, (ii) to classify signals into different categories, (iii) to analyze Linear Time Invariant (LTI) systems in time and transform domains, and (iv) to build foundation for understanding of courses such as control system and signal processing.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Classification of Signals and Systems** Introduction to signals and systems: Continuous Time (CT) and Discrete Time (DT) signals, Periodic and Aperiodic signals, Even and Odd signals, Energy and Power signals, Deterministic and Random signals. Standard signals: Impulse, Step, Ramp, Pulse, Real and Complex exponential and Sinusoidal. Classification of systems: CT and DT, Memory and Memoryless, Casual and Noncasual, Inverse, Stable and Unstable, Time-variant and Time-invariant, Linear and Non linear systems.	5
2	**Linear Time Invariant (LTI) systems** Discrete time LTI systems, Continuous time LTI systems, Properties of LTI systems.	7
3	**Fourier Series Representation of Periodic Signals** Introduction, A historical perspective, The response of LTI systems to complex exponentials, Fourier series representation of continuous time periodic signals and discrete time periodic signals, Properties of CT Fourier series and DT Fourier series, Fourier series and LTI systems, Filtering, Examples of CT filters described by differential equations.	9
4	**The Continuous Time Fourier Transform (CTFT)** Introduction, Representation of aperiodic signals – CTFT, Fourier transform for periodic	8

	signals, Properties of CTFT, Convolution property.	
5	**The Discrete Time Fourier Transform (DTFT)** Introduction, Representation of aperiodic signals, Fourier transform for periodic signals, Properties of DTFT, Convolution property.	**8**
6	**The Laplace Transform (Review)** Introduction, Definition, Region of convergence (ROC), Inverse Laplace transform, Properties of the Laplace transform, Analysis and characterization of LTI systems using the Laplace transform: Causality, Stability.	**3**
7	**The Z-Transform** Introduction, Definition, Region of convergence (ROC), Inverse z-transform, Geometric evaluation of the Fourier transform from the pole-zero plot of First order and Second order systems, Properties of the Z-transform, Analysis and characterization of LTI systems using Z-transform, System function algebra and block diagram representations.	**8**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
0 to 10	**10 to 21**	**21**	**14**	**14**	**-**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Signals & Systems, Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, Second Edition, PHI publications.
2. Signals and Sytems, Simon Haykin and Barry Van Veen, John Wiley and Sons, Second Edition, 2004.
3. Signal and Linear System Analysis, Gordon E. Carlson, Allied Publishers Limited.
4. Signals and Systems, A Anandkumar, PHI publications.
5. Signals and Systems, S Poornachandra and B Sasikala, McGraw Hill Education (India) Pvt. Ltd.

Course Outcomes:

Sr. No.	**CO statement**	**Marks % weightage**
	After successful completion of course students will be able to	

CO-1	classify various types of signals and systems, and perform various operations on them.	15
CO-2	analyze CT and DT systems in time domain using convolution.	20
CO-3	use transforms for the analysis of signals and systems in continuous and discrete time domain.	40
CO-4	analyze DT systems using z-transforms.	25

List of Experiments:

Write the programs in MATLAB/Scilab

1. Generate an impulse, step, and square waveforms in continuous and discrete domain.
2. Generate sinusoidal waveforms of different frequencies in continuous and discrete domain. Understand the difference between CT and DT waveforms.
3. Generate growing exponential, decaying exponential, and exponentially damped sinusoidal signals.
4. Find the discrete/continuous convolution between two sequences/signals. Verify the commutative, distributive and associative properties of convolution.
5. Perform folding, shifting and scaling on a given signal x(t) to obtain a signal of the form x(at+b).
6. Find the output of the system with given input (e.g. x[n]=2 {u[n+2] – u[n-12]}) and given impulse response (e.g. $h[n]= 0.9^n$ {u[n+2] – u[n-12] }.
7. Obtain the impulse response h[n] of the systems.
8. Compute FT and DTFT of the continuous time signals and discrete time sequences.
9. Find the partial fraction expansion of the given z-transform.
10. Given an LTI system with transfer function, plot its (i) pole-zero plot in the z-plane and (ii) frequency response.
11. Convert pole-zero gain form of z-transform to second order systems.

Major Equipment:
Computer Lab
MATLAB/Scilab software

List of Open Source Software/learning website:

1. MIT open courseware, Signals and Systems, Prof. Dennis Freeman https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-003-signals-and-systems-fall-2011/lecture-videos/

2. NPTEL lectures on signals and systems.

GUJARAT TECHNOLOGICAL UNIVERSITY

INSTRUMENTATION & CONTROL ENGINEERING (17)
Bachelor of Engineering
Subject Code: 3131706
Semester – III
Subject Name: Measurement & Instruments

Type of course: Engineering Science

Prerequisite: Basic Electrical Engineering, physics.

Rationale: To prepare students for experiments and design with various electrical, electronic measurements and instrumentation systems.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Introduction:** Types of instruments: Indicating, recording, integrating, etc. **Experimental Data and Errors:** Measurement Recording and Reporting, Graphical Presentation of Data, Precision and Accuracy, Resolution and Sensitivity, Errors in Measurement, Statistical Evaluation of Measurement Data and Errors	4
2	**Analog DC and AC meters:** Electromechanically meter movements,PMMC, Analog DC ammeters, Analog DC voltmeters, Analog AC ammeters and Voltmeters, Analog multimeters, Special purpose analog meters, Use of basic meters, meter errors, problems. Extending the range of meters, Loading effects and their elimination, true rms voltmeters.	5
3	**Digital Meters:** DVM and Digital multimeter, vector voltmeters, 7 Segment and LCD display.	3
4	**Oscilloscope:** Oscilloscope subsystem, Principle of Operation, Lissajous patterns oscilloscope photography, Digital storage oscilloscopes (DSO), Power scope. Attenuation probes, problems	3
5	**Time & Frequency Measurement:** Time Measurements, Frequency measurement, Harmonic Analysis and spectrum analyzers, Frequency Mixer problems.	3
6	**Power & Energy Measurement:** Power in AC-DC circuits, single-phase power measurements, Poly-phase power and measurements, Measurement of Power factor, Electrical energy measurements, Power measurements problems	4

7	**Measurement of Resistance & Bridges :** Resistance and resistor, resistor type, measurement of resistance, Wheatstone Bridge, Making balanced Wheatstone Bridge measurement, Low value resistance measurement (Kelvin Double Bridge), problems. **Measurement of Capacitance, Inductance, and Impedance:** Hays Bridge, Schering Bridge, Maxwell bridge, Anderson Bridge, Q-factor, Capacitance and capacitors, capacitor circuit models and losses, capacitor types, color coding of capacitor, Inductor and Inductance, Inductor structure, Transformers, Impedance, Capacitance and Inductance, Capacitance and Inductance measurement, complete impedance measurement, frequency measurement, problems	**6**
8	**Current and Potential transformers**: Testing and Applications.	**2**
9	**A.C. Signal Sources:** Sweep Frequency generators, Pulse generators, Function generators, Oscillators **Interference Signals and Their Elimination:** Capacitance interference, inductive interference and shielding, electromagnetic interference and shielding, conductive coupling interference, ground loop interference and input guarding to reduce it internal noise.	**3**
10	**Data transmission in Digital Instrument System:** RS 232C Standard, 20mA Current Loop	**3**

Note: Sequential Design Example* (Tutor/Instructor/Teacher has to select one case study and carry forward same to teach all the topics of syllabus.)

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
28	**28**	**7**	**7**	**7**	**-**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Wolf & Smith, Student reference manual for Electron ic and Instrumentation measurement, PHI Publication.

2. E.W. Golding and F.C. Widdis, Electrical measurements and measuring instruments, Pitman Publishing.
3. Bemard Oliver and John Cage, Electronic Measurement s and Instrumentation, Tata Mcgraw Hill.
4. William d.Cooper, Albert d. Helfrick, Electronic Instrumen tation and measurement techniques, Prentice – Hall.
5. A.K.Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpatrai Publication.
6. H.S. Kalsi, Electronic instrumentation.
7. Kim Fowler, Electronic Instrument Design, OUP, USA, 1996.

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Operate modern electrical and electronic instruments like CRO, DSO, DMM and other digital and analog instruments for appropriate measurement parameters.	30
CO-2	Able to measure time, frequency, power and energy parameter and use AC & DC bridges concept and their application for relevant parameter measurement.	40
CO-3	Able to test and troubleshoot electronic circuits using CT and PT. Carry out analysis of interference signals and their elimination for various applications.	30

List of Experiments:

1. Measurement of the voltage and Current using Analog Meter.
2. Extend the range of given ammeter and Voltmeter.
3. Measurement of unknown resistance with Wheatstone bridge.
4. Measurement of low resistance with Kelvin double bridge.
5. Measurement of unknown Inductance with a.c. bridge
6. Measurement of unknown capacitance with a.c. bridge.
7. Operation of CRO, DSO for voltage, current and frequency measurement, Lissajous patterns, phase angle measurements.
8. Calibration of single phase energy meter direct loading.
9. Calibration of single energy meter.
10. Measurements of power factors.
11. Develop application using CT and PT.
12. Develop application using RS-232C and 4-20mA current Loop.

Major Equipment:

CRO, DSO, AC/DC bridges, LCR meter, Power and Energy meters, load trolley etc.

List of Open Source Software/learning website:

1. http://nptel.iitk.ac.in/courses/Elec_Engg/IIT%20Bombay/Electrical%20and%20Electronic%20Measur ements.htm

GUJARAT TECHNOLOGICAL UNIVERSITY

INSTRUMENTATION & CONTROL ENGINEERING (17)
Bachelor of Engineering
Subject Code: 3131707
Semester – III
Subject Name: Network Analysis

Type of course: Professional Core Course

Prerequisite: Fundamental knowledge of electric circuit sources and elements, basic mathematics (integration, differentiation, etc.)

Rationale: Students of IC Engineering need to possess good understanding of concepts and principles of passive circuit analysis and synthesis by applying various circuit laws and theorems. This is one of the foundation courses which are required to understand the concepts of advanced courses and develop skills that are needed in Electronics field.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs
1	**Coupled Circuit and Dot Conventions:** Magnetically Coupled Circuit, Faraday's law of Electromagnetic induction, Self-induced emf and self-inductance, Mutually induced emf and Mutual induction, Coefficient of coupling, Dot Convention, inductive coupling of series-parallel, Conductively coupled equivalent circuit.	3
2	**Nodal Analysis and Mesh Analysis of resistive Circuits:** Nodal Analysis of Circuits Containing Resistors and Independent and Dependent Sources – Source Transformation Theorem for circuits with independent sources – Source Transformation Theorem for circuits with Dependent sources –Nodal Analysis of Circuits Containing Dependent Sources - Mesh Analysis of Circuits with Resistors and Independent Voltage Sources- Mesh Analysis of Circuits with Independent Sources - Mesh Analysis of Circuits Containing Dependent Sources.	5
3	**Circuit Theorems and Their Application in Electric Networks:** Linearity of a Circuit and Superposition Theorem-Substitution Theorem-Compensation Theorem - Thevenin's Theorem and Norton's Theorem -Determination of Equivalents for Circuits with Dependent Sources -Reciprocity Theorem - Maximum Power Transfer Theorem - Millman's Theorem-Duality Theorem - Duality between Electricity and	6

	Magnetism	
4	**Time domain response of First order RL and RC circuits:** Mathematical preliminaries – Source free response –DC response of first order circuits – Superposition and linearity – Response Classifications	**4**
5	**Time domain response of Second order linear circuits:** Discharging of a Capacitor through an inductor – Source free second order linear networks – second order linear networks with constant inputs.	**4**
6	**Initial Conditions:** Initial conditions in elements, procedure for evaluating initial conditions, Solution of circuit equations by using Initial Conditions.	**4**
7	**Laplace Transform Analysis and its Applications:** Notions of Impedance and Admittance – Manipulation of Impedance and Admittance- Notions of Transfer Function- Equivalent circuits for inductors and capacitors – Nodal and Loop analysis in the s-domain – Switching in RLC circuits- Switched capacitor circuits and conservation of charge	**5**
8	**Two –Port Networks :** One port networks –Driving Port and Transfer function for one port and two port network, Poles and zeroes of network functions, Two port admittance Parameters (y parameters)– Admittance parameters analysis of terminated two- Port networks - Two port impedance Parameters (z-parameters) –Impedance and Gain calculations of terminated two- Port networks modeled by z-parameters – Hybrid parameters (h para)– Inverse Hybrid Parameters (g-para)- Transmission parameters (ABCD parameters)-Scattering parameters(S parameters)-Scattering Transfer parameters(T parameters) –reciprocity- Various Combinations of Two-Port network-Various Combinations of Two port n/w.	**7**
9	**Introduction to Network Topology:** Linear Oriented Graphs (Connected Graph, Sub graphs and Some Special Sub graphs) - The Incidence Matrix of a Linear Oriented Graph -Kirchhoff's Laws in Incidence Matrix Formulation - Nodal Analysis of Networks – The Circuit Matrix of a Linear Oriented Graph- Kirchhoff's Laws in Fundamental Circuit Matrix Formulation - Loop Analysis of Electrical Networks – (Loop Analysis of Networks Containing Ideal Dependent Sources- Planar Graphs and Mesh Analysis –Duality)- The Cut-set Matrix of a Linear Oriented Graph (Cut-sets - The All cut-set matrix Qa- Orthogonality relation between Cut-set matrix and Circuit matrix - The Fundamental Cut-set Matrix Qf - Relation between Qf , A and Bf) - Kirchhoff's Laws in Fundamental Cut-set formulation - Tie set -Tie set Matrix (F-loop matrix)- Tie set schedule.	**7**

GUJARAT TECHNOLOGICAL UNIVERSITY

INSTRUMENTATION & CONTROL ENGINEERING (17)
Bachelor of Engineering
Subject Code: 3131707

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	**20**	**10**	**10**	**10**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Network Analysis & Synthesis By Franklin S. KUO, Wiley Publication
2. Network Analysis :- By M.E Van Valkenburg PHI Publication
3. Electric Circuits and Networks :- By K. S. Suresh Kumar – Pearson Education
4. Linear Circuits Analysis 2nd edition :-By DeCarlo/ Lin – Oxford University Press(Indian edition)
5. Engineering Circuit Analysis : - By W H Hayt, J E Kemmerly, S M Durbin 6th Edition TMH Publication
6. Graphs: Theory and Algorithms By K. Thulasiraman, m.n.s Swamy, Wiley Publication.
7. Electric Circuit Analysis By S N Sivanandam, Vikas Publishing House
8. Introductory Circuit Analysis by Robert Boylestad, Pearson

Course Outcomes:

Sr. No.		Marks % weightage
CO-1	Apply dot convention & node convention analysis to various circuits.	20 %
CO-2	To apply node and mesh circuit analysis techniques and various network theorems such as Superposition, Thevenin, Norton, Reciprocity, Maximum Power Transfer, Millman's Theorem, etc.	40%
CO-3	Calculate Laplace Transform on one port and two port network.	20%
CO-4	To apply graph theorem to solving networks.	20%

List of Experiments:

1. To measure and calculate currents and voltages for a given resistive circuit and verify KCL and KVL**.**
2. To verify superposition theorem experimentally for a given resistive circuit consisting two independent sources**.**

3. To verify Thevenin's theorem experimentally for a given circuit**.**
4. To verify maximum power transfer theorem experimentally for a given circuit**.**
5. To verify reciprocity theorem experimentally for a given circuit.
6. To measure and calculate RC time constant for a given RC circuit.
7. To measure and calculate RC time constant for a given RL circuit**.**
8. To measure and analyze (settling time, overshoot, undershoot, etc.) step response of for a given series RLC circuit for following cases: (1) $\zeta = 1$ (critically damped system), (2) $\zeta > 1$(over damped system), (3) $\zeta < 1$ (under damped system). Choose appropriate values of R, L, and C to obtain each of above cases one at a time.
9. To measure and calculate Z-parameters for a given two-port system**.**
10. To measure and calculate Y-parameters for a given two-port system**.**
11. To measure and calculate h-parameters for a given two-port system**.**
12. To measure and calculate ABCD-parameters for a given two-port system.

Major Equipment:

1. Function Generator
2. Oscilloscope
3. Digital Multi-meter
4. DC Power Supply (0-30 V)

List of Open Source Software/learning website:

Multisim, PSPice, NGspice

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130004
Semester – III
Subject Name: Effective Technical Communication

Type of course: Communication and ethics

Prerequisite: Zeal to learn the subject

Rationale: The rationale of the curriculum is to help students learn technical communication along with necessary moral and ethical dimensions of engineering.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

Contents:

Sr. No.	Topics	Teaching Hours	Module Weightage
1	**Dynamics of Communication**: Definition and process Kinesics Proxemics Paralinguistic features Importance of Interpersonal and Intercultural Communication in today's organizations	06	20%
2	**Technical Writing**: Report writing Technical proposal Technical description Business letters(sales, order, complaint, adjustment, inquiry, recommendation, appreciation, apology, acknowledgement, cover letter) Agenda of meeting, Minutes of meeting Resume writing	08	25%
3	**Technical Communication**: Public speaking Group discussion Presentation strategies Interview skills Negotiation skills Critical and Creative thinking in communication	06	20%
4	**Ethics in Engineering**: Scope of engineering ethics Accepting and sharing responsibility Responsible professionals and ethical corporations Resolving ethical dilemmas Making moral choices	04	12%
5	**Etiquettes**: Telephone etiquettes Etiquettes for foreign business trips Visits of foreign counterparts Etiquettes for small talks	05	16%

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130004

	Respecting privacy Learning to say NO Time management		
6	**Self-development and Assessment:** Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record, Remember, Asses, Think, Communicate, Relate, Dream.	03	7%

Distribution of Theory Marks					
Remember	Understand	Analysis	Application	Evaluation	Creativity
05	**05**	**15**	**15**	**15**	**15**

Language Laboratory Activities:

Sr. No.	**Practical/ Exercise**	**Apprx. Hours required**	**Preferably to be conducted in:**
1	Role Play	02	Classroom/Hall
2	Letter writing: Formal	02	Classroom/Lab
3	Group Discussion	04	Classroom/Hall
4	Presentations	04	Classroom/Hall
5	Book Review(Preferably related to self-development)	04	Classroom/Hall
6	Mock Interview	04	Classroom/Hall
7	Report writing	02	Classroom/Lab
8	Case studies related to unit 4, 5 and 6	06	Classroom/Lab
9	Conducting meetings and minutes of meeting	02	Classroom/Hall
10	Practical assessment	02	Classroom/Lab

Suggested books for review:

1. You Can Win by Shiv Khera
2. How to Win Friends and Influence People by Dale Carnegie
3. Getting Things Done: The Art of Stress Free Productivity by David Allen
4. Quiet: The Power of Introverts in a World That Can't Stop Talking by Susan Cain
5. The Alchemist by Paulo Coelho
6. The 7 Habits of Highly Effective People by Stephen Covey
7. What to Say When You Talk to Yourself by Dr. Shad Helmstetter
8. The Big Leap by Gay Hendricks
9. Thinking Fast and Slow by Daniel Kahneman
10. The Art of Thinking Clearly by Ralf Dobelli
11. Upside Down Key by Sudha Murthy
12. Born to be Happy by Pramod Batra
13. Kiss That Frog by Brian Tracy

14. Build From Scratch by Vineet Bajpai
15. Ten Much by A G Krishnamoorthy
16. Poor Little Rich Slum by Rashmi Bansal
17. Our Ice Berg is Melting by John Paul Cotter
18. Most and More by Mahatria Ra
19. Third Curve by Mansoor Ali Khan
20. Selected Short Stories of Rabindranath Tagore edited by William Radice
21. That Thou Art by Dhruv Bhatt
22. Old Man and the Sea by Ernest Hemingway

Reference Books:

1. Raman and Sharma, *Technical Communications*, OUP, New Delhi, 2017
2. Lata and Kumar, *Communication Skills*, OUP, New Delhi, 2018
3. Mike Martin and Roland Schinzinger, *Ethics in Engineering*, McGraw Hill, New York, 2014
4. Mohapatra and Sreejesh S., *Case Studies in Business Ethics and Corporate Governance*, Pearson, UP, 2013
5. Ramesh and Ramesh, *The Ace of Soft Skills*, Pearson, UP, 2019
6. Sherfield, Montgomery and Moody, *Cornerstone: Developing Soft Skills*, UP, 2009

Open Sources:

https://www.scu.edu/ethics/focus-areas/more/engineering-ethics/engineering-ethics-cases/

Course Outcomes:

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

Sr. No.	Course Outcome	Weightage
1	Define and discuss dynamics of Verbal and Non Verbal aspects of Communication	20%
2	Write various formal documents of technical and professional communication	25%
3	Communicate in diverse formal situations taking place in organizations	20%
4	Illustrate and examine the knowledge of ethical aspects of engineering	12%
5	Demonstrate and explain social and professional etiquettes	16%
6	Plan self-development and practice self-assessment	7%

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130007
Semester – III
Subject Name: Indian Constitution

Type of course: Mandatory course

Prerequisite: NA

Rationale: NA.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	0	0	50	0	0	0	50

Contents:

Sr. No.	Topics	Total Hours
1	Meaning of the constitution law and constitutionalism	01
2	History of Indian Constitution	02
3	Salient features and characteristics of the Constitution of India	01
4	Fundamental rights	02
5	Right to Equality under Article – 14	02
6	Right to certain Freedom under Article 19	02
7	Scope of the Right to Life and Personal Liberty under Article 21	02
8	Fundamental Duties and its legal status	02
9	The Directive Principles of State Policy – Its importance and implementation	02
10	Federal structure and distribution of legislative and financial powers between the Union and the States	03
11	Parliamentary Form of Government in India – The constitution powers and status of the President of India	02
12	Powers and Procedure for Amendments in Indian Constitution	01
13	History of amendments in Indian Constitutional	02
14	Emergency Provisions : National Emergency, President Rule, Financial Emergency	03
15	Local Self Government – Constitutional Scheme in India	03

Course Outcomes:

Sr. No.	CO statement	Marks % weightage
CO-1	Enhance human values , create awareness about law enactment and importance of Consitution	10%
CO-2	To Understand the Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsbilities.	30%
CO-3	Create Awareness of their Surroundings, Society, Social problems and their sutaible solutions while keeping rights and duties of the citizen keeping in mind.	20%
CO-4	Understand distribution of powers and functions of Local Self Government.	20%
CO-5	Understand the National Emergency, Financial Emergency and their impact on Economy of the country.	20%

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130007

Reference Books :

1. Constitutional Law of India, Dr. J.N. Pandey, Central Law Agency
2. Introduction to the Consitution of India, Durga Das Basu, LexisNexis.
3. Indian Constitutional Law, M.P. Jain, LexisNexis
4. V.N.Shukla's Constitution of India, Mahndra Pal Singh, Eastern Book Company
5. Constitutional Law – I Structure, Udai Raj Rai, Eastern Book Company

GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3130008
Semester III
Design Engineering 1 A
Module 1: Understanding Design Thinking

Type of Course: Project Work

Prerequisite: Optimistic mind-set, Enthusiasm of learning new things, Unlearn yourself

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
0	0	2	1	0	0	80	20	100

Relevance

This course is meant for beginners. The course is designed to imbibe Design Thinking understanding and mind-set for the 3rd semester students.

Objective: Understanding Design Thinking

The course aims to expose students to the basic process and framework of Design Thinking and relevant tools & techniques for Creativity & Innovation.

Course Contents

This Course is designed to give very basic understanding of the Design Thinking methodology. In DE-1A, student will select very basic and small, individual or team project irrespective of their branch. This project would be from very general topic/domain like designing something for yourself/parents/Teacher/Friends (Whole class may select single project topic or similar topic in different small groups to have healthy competition among the class). This kind of basic project in 3rd semester would help in understanding of Design Thinking process easily when much technicality is not involve. In this module, student will use whole Design Thinking process as shown in fig.1 of general guideline document to complete their projects but here the learning objective or focus would be more on Observation or Empathy process. So students need to give more time to these phases and then reach up to the rough prototype phase. The content is divided into week-wise activities as shown below to better understand the course and to give enough time to all the learning aspects and students need to follow the same but depending upon the type and nature of projects, students and guide may allocate more/less time to the activities.

Design Thinking Process – with Tools & Techniques			
Module 1 (DE-1A): Understanding Design Thinking			
Broad segment	Week	Description	Operational need
Design Thinking Introduction	1	○ Overview, objective and goal of this course ○ What is Design Thinking? - Its importance, socio-economical relevance ○ Design thinking to foster innovation ○ Relevance of design and design thinking in engineering ○ Systematic problem identification & problem solving approaches	○ Brief lecture/exercise ○ Hands on exercise to understand attributes of Design Thinking
	2	○ Domain Selection (general topic/products in 3rd semester) ○ Team Building Exercise ○ Log book, documentation strategy – introduction, importance, preparation	○ Brief lecture/exercise ○ Hands-on sessions with cases/examples ○ Individual logbook is required
	3	○ Learning tools ✓ Design in nature/Bio-mimicry ✓ Design as a System approach ✓ Design as listening tool for mapping users' unmet needs	○ Brief lecture/exercise ○ Next week Students need to present on the learning from these topics
Empathization Phase	4,5,6	○ Observation: Through AEIOU framework ✓ Orientation to Field Work – Need for field visit? ✓ What/How/Where to Observe ✓ Ethnographic tools and its usage ✓ What difference it will make if the problem solved - partially or fully? ✓ Could solution be worse than the problem? ✓ Key pain and pleasure points ✓ Understanding of User Contexts ✓ Log book exercise ✓ Analysis of Data - Mind Mapping ○ Immerse via Role Playing	○ Students will be introduced to different observation/scouting methods in the theory session in class for all four weeks in different sessions ○ Then during weeks, they need to visit their selected domain/place for getting insights and define problems. ○ Minimum 4-5 field trips will be required to get better insights on users' needs.

		○ Interview: ✓ Formal and Informal interview ✓ Students may use Stanford methods given in below link - http://dschool.stanford.edu/wp-content/uploads/2013/10/METHODCARDS-v3-slim.pdf	
		○ Summary of AEIOU activity/inputs ○ Preparation of Mind Map, Empathy Map	○ Class as well as homework/field activity
Define Phase: Problem Definition by secondary research ,group work and presentation	7	○ Secondary research/Prior art search (prior art search is continuous activity and can be used in any phase to strengthen the idea) ○ Group wise presentation followed by Discussion ○ Define Problem statement (format is given in reference PPT on DE portal ○ Verification of problem identified by team through users/stakeholders	○ After rigorous and systematic field exercises, empathization and Secondary Research activities -student teams need to define their problem here (it can be further validate through Ideation phase)
Ideation Phase	8	○ Preparation of Ideation canvas ✓ Brainstorming (What, Why, How, When, For Whom) ✓ Situation/Context/Location ✓ Props/non-living things/tools/equipment ✓ Opportunity mapping	○ 2 hour – explanation of Ideation canvas to class ○ Then students will work on their Ideation canvas ○ Ideation activities shall be performed in class with team members under guidance of teacher
	9	○ Combination of Ideas from Ideation canvas ○ Sketching of mock concepts in log book ○ Design Thinking is a Convergent-Divergent process	○ Student teams need to discuss their Ideation canvas with other teams, faculty guides and users and take feedbacks
	10	○ Prioritizing and finalizing Idea (After group discussion and consulting with faculty guide, student teams need to select their final problem & idea for further development)	○ Students team need to validate the final Problem & idea/concept with Users/Stakeholders after this activity

Product Development Phase	11	○ Preparation of Product Development Canvas (PDC) ✓ Product Experience ✓ Product Functions ✓ Product Features ✓ Components ○ Discussion on Product Development Canvas (PDC)	○ 2 hour – explanation of product development canvas to class ○ Then students will work on their PD canvas (min 3 hour continuous workshop) ○ Till 12th week of the course, Students team will discuss on their PDC with other groups and guide ○ Refinement of PDC after discussion
	12	○ Customer/User Revalidation (Reject/Redesign/Retain) ○ Refinement	○ Till 13th week of the course, student team will consult the Users/Stakeholders for their inputs for concept finalization after various stages and incorporate necessary changes.
Proof of Concept	13	○ Rough Prototype ○ Here strategy is "to fail fast to succeed faster"	○ Very early & rough prototype ○ Made up of paper, cardboard, thermocol etc. whichever material is available
Feedback & Final Report	14	○ Upload duly signed Continuous Assessment Card ○ Feedback, Online certificate generation through DE portal ○ Final Report	○ As per the feedback received from Users/Stakeholders/other student groups/guide, student teams need to modify their design and further action plan. ○ Report writing should be continuous activity throughout the semester

Submissions by the end of 3rd semester shall be:

A. Process Report comprising:
   a. Introduction (Describe your project in detail including domain – type, place, why and how team selected this domain and why this domain is important in relation to Design Thinking/Human-Centered process etc.)
   b. Preparation of canvases based on different phase of Design Thinking
   c. Feedback analysis with the user shall be clearly included in the report
   d. Summary of findings of Prior Art Search on purpose/project theme (2 summary papers per student)
   e. Summary of the learning from Design Thinking
   f. Summary on validation process and refinement in the rough prototype
   g. Any other important aspects you feel should be included

B. AEIOU framework
C. Mind Map
D. Empathy Map
E. Ideation Canvas
F. Product Development Canvas (PDC)
G. Rough prototype model/Conceptual Plan-Layout for process related branches
H. Individual Log Book (duly signed by faculty guide)
I. Continuous Assessment Card for Internal Evaluation (Document separately available on GTU website)

Note: As per the guidelines and evaluation schemes given in this document, students need to prepare report for their projects. Separate report format will not be provided by University, students and faculty members may create their own creative formats. However, in general guidelines document uploaded on GTU website, there are some report format links are given which may help for report format.

To,

The Principals/Directors of Colleges/Institutes, the Heads of Departments and GTU/Design Engineering coordinators:

Students deserve a proper practical/ viva/project examination of the work that they have done over the semester (or over the year for a 2-semester project). It is the responsibility of the University and Colleges that all its examinations are conducted fairly, sincerely and with due diligence. So please look into the following:

1. Please make proper arrangements so that all the examinations start in-time. If due to any reason, the exam should not start at the scheduled time, please inform the examiners that they should take extra time. But in no case the viva/ practical exam be conducted in a hurry without giving sufficient time for evaluation of every student. If an exam is scheduled to be held over two days, please make the necessary arrangements.

2. The University expects the Deans (and or special teams headed by the Dean or his/ her nominee) to visit the Colleges during the practical/ viva examinations. As it came to University's notice that some examiners and colleges are completing viva exam in 1 or 2 hours' time of entire class which is not acceptable in any case and it's immoral practice for any education institute. So all stakeholders need to take extra care of this issue.

3. Please see that all the necessary help and information is provided to examiner. Please receive them so that they can do their job properly without wasting their time in searching for the place and in contacting the concerned departments and students. If they wish to visit the laboratories/workshops, please make the necessary arrangements.

4. Please inform the examiner that he/she must note down the best 3 projects of the department and convey the details of such projects by uploading the details of the project or/and the complete project report on the University's server or send it to design@gtu.edu.in .

5. In case Internet or the server should not work, please provide the technical help to the examiner for preparing a CD of the reports of the best three projects of every department and please make arrangements to deliver the CD to the examination/BE section of the University.

PROCESS OF EVALUATION: At the ensuing 3rd semester examinations, the work of the students in Design Engineering – 1A is to be evaluated through Internal Viva exam and the evaluation is to be out of 80 marks. Institute may organize inter-department viva or project show case so students would get various expert opinions to motivate them.

For 3rd semester, internal Viva-Voce examination will be conducted at the end of the semester by a team of three examiners - One internal guide, one inter/own departmental faculty, one industry expert (industry expert may be optional but recommended). Internal examiners/teachers must be trained in Design Thinking through the FDP conducted by University.

EVALUATION SCHEME:

Sr. No.	Particular	Sub-Head Weightage
1.	Understanding of Design Thinking methodology/ need ✓ Importance and understanding of Design Thinking for innovation, entrepreneurship, societal solutions with various learning tools	15
2.	Observation towards Empathy ✓ Field Activity/observation and outcome ✓ Mind Mapping - Summarization and data analysis ✓ Observation Technique (AEIOU Framework)	20
3.	Log book (Individual completed log book, duly signed by guide regularly) Continuous Assessment Card for Internal Evaluation (Complete and duly signed by guide regularly)	10
4.	Understanding of Canvases/Framework ✓ AEIOU, Mind Mapping ✓ Empathy mapping ✓ Ideation Canvas ✓ Product development Canvas	15
5.	Design Problem Definition ✓ Prior art search/Secondary research ✓ Diachronic and Synchronic analysis	10
6.	Report: Compilation of work report (process report), Online Certificate generated through DE Portal, Future action plan, Question and Answer, Communication Skill, Attitude	10
		80

Note:

- ✓ Total Marks for the subject: 100 (Internal end semester viva exam – 80 & Internal continuous evaluation – 20)
- ✓ Minimum passing marks: 40/80
- ✓ Examiner essentially needs to evaluate the learning process of the student during the semester, not only the final outcome. As outcome is important for any project but during the student stage, projects are intended for practical learning and "Learning by doing" is the Mantra for Design Engineering subject (One should celebrate the failure also and learn from it to get success). So

please evaluate the Design Thinking process and their learning properly with giving sufficient time for each project.

- ✓ Students need to explain all canvases prepared in hard copy to the panel of examiners.
- ✓ Power point presentation is not mandatory.