



# 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<br>C | Examination Marks |        |                 |        | Total<br>Marks |
|-----------------|---|---|--------------|-------------------|--------|-----------------|--------|----------------|
| L               | T | P |              | Theory Marks      |        | Practical Marks |        |                |
|                 |   |   |              | 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       | <b>Dynamics of Communication:</b><br>Definition and process<br>Kinesics<br>Proxemics<br>Paralinguistic features<br>Importance of Interpersonal and Intercultural Communication in today's organizations   | 06             | 20%              |
| 2       | <b>Technical Writing:</b><br>Report writing<br>Technical proposal<br>Technical description<br>Business letters(sales, order, complaint, adjustment, inquiry, recommendation, appreciation, apology, acknowledgement, cover letter)<br>Agenda of meeting, Minutes of meeting<br>Resume writing | 08             | 25%              |
| 3       | <b>Technical Communication:</b><br>Public speaking<br>Group discussion<br>Presentation strategies<br>Interview skills<br>Negotiation skills<br>Critical and Creative thinking in communication  | 06             | 20%              |
| 4       | <b>Ethics in Engineering:</b><br>Scope of engineering ethics<br>Accepting and sharing responsibility<br>Responsible professionals and ethical corporations<br>Resolving ethical dilemmas<br>Making moral choices  | 04             | 12%              |
| 5       | <b>Etiquettes:</b><br>Telephone etiquettes<br>Etiquettes for foreign business trips<br>Visits of foreign counterparts<br>Etiquettes for small talks   | 05             | 16%              |



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|   |   |    |    |
|---|---|----|----|
|   | Respecting privacy<br>Learning to say NO<br>Time management   |    |    |
| 6 | <b>Self-development and Assessment:</b><br>Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record,<br>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



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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: 3130006

Semester – III

Subject Name: Probability and Statistics

**Type of course:** Basic Science Course

**Prerequisite:** Probability basics

**Rationale:** Systematic study of uncertainty (randomness) by probability - statistics and curve fitting by numerical methods

**Teaching and Examination Scheme:**

| Teaching Scheme |   |   | Credits | Examination Marks |         |                 |   | Total Marks |
|-----------------|---|---|---------|-------------------|---------|-----------------|---|-------------|
| L               | T | P |         | Theory Marks      |         | Practical Marks |   |             |
|                 |   |   | ESE (E) | PA (M)            | ESE (V) | PA (I)          |   |             |
| 3               | 2 | 0 | 5       | 70                | 30      | 0               | 0 | 100         |

**Content:**

| Sr. No. | Content  | Total Hrs | % Weightage |
|---------|--|-----------|-------------|
| 01      | <b>Basic Probability:</b><br>Experiment, definition of probability, conditional probability, independent events, Bayes' rule, Bernoulli trials, Random variables, discrete random variable, probability mass function, continuous random variable, probability density function, cumulative distribution function, properties of cumulative distribution function, Two dimensional random variables and their distribution functions, Marginal probability function, Independent random variables. | 08        | 20 %        |
| 02      | <b>Some special Probability Distributions:</b><br>Binomial distribution, Poisson distribution, Poisson approximation to the binomial distribution, Normal, Exponential and Gamma densities, Evaluation of statistical parameters for these distributions.  | 10        | 25 %        |
| 03      | <b>Basic Statistics:</b><br>Measure of central tendency: Moments, Expectation, dispersion, skewness, kurtosis, expected value of two dimensional random variable, Linear Correlation, correlation coefficient, rank correlation coefficient, Regression, Bounds on probability, Chebyshev's Inequality   | 10        | 20%         |
| 04      | <b>Applied Statistics:</b><br>Formation of Hypothesis, Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and Difference of standard deviations.<br>Test of significance for Small samples:<br>t- Test for single mean, difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.                                     | 10        | 25 %        |
| 05      | Curve fitting by the numerical method: Curve fitting by of method of least squares, fitting of straight lines, second degree parabola and more general curves.   | 04        | 10 %        |



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Suggested Specification table with Marks (Theory):

| Distribution of Theory Marks |         |         |         |         |         |
|------------------------------|---------|---------|---------|---------|---------|
| R Level                      | U Level | A Level | N Level | E Level | C Level |
| 7                            | 28      | 35      | 0       | 0       | 0       |

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 from above table. This subject will be taught by Maths faculties.

## Reference Books:

- (1) P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall.
- (2) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India.
- (3) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
- (4) D. C. Montgomery and G. C. Runger, Applied Statistics and Probability for Engineers, Wiley.
- (5) J. L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning.

## Course Outcome:

| Sr. No. | CO statement   | Marks % weightage |
|---------|--|-------------------|
| CO-1    | understand the terminologies of basic probability, two types of random variables and their probability functions                         | 20 %              |
| CO-2    | observe and analyze the behavior of various discrete and continuous probability distributions  | 25 %              |
| CO-3    | understand the central tendency, correlation and correlation coefficient and also regression   | 20%               |
| CO-4    | apply the statistics for testing the significance of the given large and small sample data by using t- test, F- test and Chi-square test | 25 %              |
| CO-5    | understand the fitting of various curves by method of least square   | 10 %              |

## List of Open Source Software/learning website:

MIT Opencourseware. NPTEL.



# 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<br>C | Examination Marks |        |                 |        | Total<br>Marks |
|-----------------|---|---|--------------|-------------------|--------|-----------------|--------|----------------|
| L               | T | P |              | Theory Marks      |        | Practical Marks |        |                |
|                 |   |   |              | 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 Responsibilities. | 30%               |
| CO-3    | Create Awareness of their Surroundings, Society, Social problems and their suitable 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%               |



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**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

GTUQuestionPapers.com



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3131101

Semester III

Control Systems

**Type of course:** Modeling, performance analysis and control with potential application to engineering systems.

**Prerequisite:** Knowledge of Linear algebra, Differential equations and Laplace transform.

**Rationale:** This course explores the fundamentals of systems and control. The course has following primary focuses:

- (1) Understanding and predicting behavior of the system.
- (2) Differentiate between the open loop and closed loop systems.
- (3) Design and analysis of closed loop control systems.
- (4) Analyze the condition for system stability.
- (5) Understand different methods for finding the relative and absolute stability of the system.
- (6) Evaluate the performance of the system for different excitations.

### Teaching and Examination Scheme:

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

| Sr. No. | Topics   | Teaching Hrs | Module Weightage |
|---------|--|--------------|------------------|
| 1       | Introduction to Control Systems: Introduction, Brief History of Automatic Control, Examples of Control Systems, Engineering Design, Mechatronic Systems, The Future Evolution of Control Systems.  | 2            | 4%               |
| 2       | Mathematical Models of Systems: Differential Equations of Physical Systems, Linear Approximations of Physical Systems, The Laplace Transform, The Transfer Function of Linear Systems, Block Diagram Models, Signal-Flow Graph Models.   | 5            | 12%              |
| 3       | Feedback Control System Characteristics: Error Signal Analysis, Sensitivity of Control Systems to Parameter Variations, Disturbance Signals in a Feedback Control System, Control of the Transient Response, Steady-State Error, The Cost of Feedback.   | 3            | 8%               |
| 4       | The Performance of Feedback Control Systems: Test Input Signals, Performance of Second-Order Systems, Effects of a Third Pole and a Zero on the Second-Order System Response, Transient Response, The Steady-State Error of Feedback Control Systems, Performance Indices, The Simplification of Linear Systems. | 5            | 10%              |
| 5       | The Stability of Linear Feedback Systems: The Concept of Stability, relative stability analysis, Routh-Hurwitz criteria.   | 2            | 10%              |
| 6       | The Root Locus Method: The Root Locus Concept. The Root Locus Procedure, Parameter Design by the Root Locus Method, Sensitivity and the Root Locus, Three-Term (PID) Controllers.  | 5            | 12%              |





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|              |  |           |             |
|--------------|--|-----------|-------------|
| 7            | Frequency Response Methods: Frequency Response Plots, Frequency Response Measurements, Performance Specifications in the Frequency Domain, Log Magnitude and Phase Diagrams.   | 3         | 8%          |
| 8            | The Design of Feedback Control Systems: Approaches to System Design, Cascade Compensation Networks, Phase-Lead Design Using the Bode Diagram, Phase-Lead Design Using the Root Locus, System Design Using Integration Networks, Phase-Lag Design Using the Root Locus, Phase-Lag Design Using the Bode Diagram, Design on the Bode Diagram Using Analytical Methods. | 6         | 12%         |
| 9            | Stability in the Frequency Domain: Mapping Contours in the s-Plane, The Nyquist Criterion, Relative Stability and the Nyquist Criterion, Time-Domain Performance Criteria in the Frequency Domain, System Bandwidth, The Stability of Control Systems with Time Delays.  | 5         | 12%         |
| 10           | State Variable Models: The State Variables of a Dynamic System, The State Differential Equation, Signal-Flow Graph and Block Diagram Models, Alternative Signal-Flow Graph and Block Diagram Models, The Transfer Function from the State Equation, The Time Response and the State Transition Matrix.   | 6         | 12%         |
| <b>Total</b> |  | <b>42</b> | <b>100%</b> |

## Distribution of Theory Marks for Cognitive level

| R Level | U Level | A Level | N Level | E Level | C Level |
|---------|---------|---------|---------|---------|---------|
| 20      | 15      | 15      | 20      | 20      | 10      |

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

*\*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 from above table*

### Reference Books:

1. Control Systems Engineering by Nagrath and Gopal New Age Publication
2. Modern Control Engineering by Katsuhiko Ogata, 4th Edition, Prentice Hall of India.
3. Modern Control System by Richard C. Drof and Robert H. Bishop, 11th Edition Person Int.
4. Automatic Control Systems by Benjamin C.Kuo, 8th Edition, Farid Golnaraghi, John Wiley & Sons.
5. Feedback and Control Systems by Joseph J Distefano 2<sup>nd</sup> Edition TMH

### Course Outcomes:

After learning the course the students should be able to:

| Sr. No. | CO statement   | Marks % weightage |
|---------|--|-------------------|
| CO-1    | analyze and Evaluate system behavior in time and frequency domains based on the mathematical model of the system.          | 25                |
| CO-2    | apply control theory to linear system for system modeling using differential equations and transfer function realizations. | 20                |



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|      |   |    |
|------|---|----|
| CO-3 | analyze and apply all the stability techniques for closed loop system performance parameters.                                 | 25 |
| CO-4 | comprehend the need of different types of controllers and compensators to obtain the required dynamic response of the system. | 15 |
| CO-5 | synthesis system equations for state space models of linear systems.  | 15 |

## List of suggested Experiments:

1. Simulation of DC motor working
2. Simulation of synchros
3. Generating standard test signals i.e. step, ramp, unit impulse on a simulator
4. Analysis of time response of second order system.
5. Effect of P, PD, PI, PID Controller on a second order systems.
6. Plotting root locus of a given transfer function using a simulator.
7. Temperature control using PID.
8. Plotting phase magnitude plot of a given transfer function with a simulator.
9. Obtaining frequency response of a common emitter amplifier and plotting on a Bode plot.
10. Simulation of a given transfer function using OPAMPs.
11. Stability Analysis ( Root locus, Bode, Nyquist) of Linear Time Invariant System.
12. Study of a PLL as a closed loop control system on a simulator.

Use SCILAB/MATLAB or other equivalent software as a simulator.

**Lab Work:** SCILAB/ MATLAB based assignments and simulations covering design, analysis and modelling of control systems relevant to curriculum.

## List of Open Source Software/learning website:

Ng-spice/MATLAB, [www.nptel.com](http://www.nptel.com)



# GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering

Subject Code: 3131102

Semester III

Digital System Design

**Type of course:** Design and Analysis of Digital Circuits

**Prerequisite:** Basic Electronics and Number Systems.

**Rationale:** The students need to learn basic concepts of digital circuits and system which leads to design of complex digital system such as microprocessors. The students need to know combinational and sequential circuits using digital logic fundamentals. The students will learn the design of combinational and sequential circuit. This is the first course by which students get exposure to digital electronics world.

**Teaching and Examination Scheme:**

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

| Sr. No. | Content  | Total hours | % Weightage |
|---------|--|-------------|-------------|
| 1       | Review of number systems, logic gates, Boolean algebra - postulates and theorems, SOP & POS forms, canonical forms, logic minimization using Karnaugh Map and tabulation methods up to 6 variables, Realizing logic functions using gates.   | 7           | 15          |
| 2       | Combinational logic circuit design: half adder full adder, BCD adder, code converters, magnitude comparator, multiplexers and decoders, MSI digital circuit design problems.   | 8           | 15          |
| 3       | Sequential logic circuit design: Flip Flops-SR, JK, T, D and master-slave FF, ripple and synchronous counters, shift registers.  | 7           | 15          |
| 4       | Introduction to Finite State Machines (FSM): The need for state machines, The state machine, basic concepts in state machine analysis.   | 5           | 10          |
| 5       | Synchronous state machine design: Sequential counters, state changes referenced to clock, number of state flip-flops, input forming logic, output forming logic, generation of a state diagram from a timing chart, redundant states, general state machine architecture. Concept of asynchronous state machine and comparison to synchronous state machine. | 9           | 15          |
| 6       | Logic families: Specifications, noise margin, propagation delay, fan-in, fan-out, Transistor-Transistor Logic (TTL), Emitter-Coupled Logic (ECL), CMOS Logic, TTL and CMOS Gates, Introduction to basics of FINFET   | 5           | 10          |
| 7       | Programmable Logic Devices: Introduction to Programmable Logic Devices, Read-Only Memory, Programmable Logic Arrays (PLA), Programmable Array Logic (PAL), Combinational PLD-Based State Machines, State Machines on a Chip.   | 5           | 10          |
| 8       | VLSI Design flow: Design entry: Schematic, FSM & HDL, different modeling styles in Verilog: Behavioral and Structural Modeling, Data types and objects, Synthesis and Simulation Verilog constructs and codes for combinational and sequential circuits.   | 5           | 5           |
| 9       | A to D Converter and D to A Converter: Introduction, Digital to Analog   | 5           | 5           |



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|  |  |           |            |
|--|--|-----------|------------|
|  | Conversion : Weighted Resistor D/A Converter, R-2R Ladder D/A Converter, Specifications for D/A Converters, An Example of D/A Converter IC: Digital Input Codes, Analog output, Calibration, Sample and Hold, Analog to Digital Converters: Quantization and Encoding, Parallel Comparator A/D Converter, Counting A/D Converter, Dual Slope A/D Converter, A/D Converter Using Voltage to frequency conversion, A/D Converter Using Voltage to time conversion, Specification of A/D Converters An Example of A/D Converter IC: Operation , Digital Output, Analog Input, Calibration |           |            |
|  | <b>Total</b>   | <b>56</b> | <b>100</b> |

### Suggested Specification table\* with Marks (Theory):

| Distribution of Theory Marks |           |           |           |          |          |
|------------------------------|-----------|-----------|-----------|----------|----------|
| R Level                      | U Level   | A Level   | N Level   | E Level  | C Level  |
| <b>20</b>                    | <b>20</b> | <b>10</b> | <b>10</b> | <b>5</b> | <b>5</b> |

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

*\*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 from above table.*

### Reference Books:

1. Digital Logic & State Machine Design By David J. Comer, Third Indian Edition, Oxford University Press
2. Digital Logic and Computer Design By M Morris Mano, Fourth Edition, Prentice Hall Publication
3. Digital Principles and Applications By Malvino & Leach, Seventh Edition, McGraw-Hill Education
4. Modern Digital Electronics By R.P.Jain, Fourth Edition, Tata McGraw-Hill Education.
5. Digital Electronics: Principles and Integrated Circuits By A.K. Maini, Wiley India Publications
6. Digital Design M. Morris Mano and Michael D. Ciletti, Pearson Education
7. A Verilog HDL Primer by J. Bhaskar, Third Edition, BS Publication
8. Fundamentals of Digital Logic with Verilog Design by Brown and Vrenesic, Second Edition, McGrawHill publication.

### Course Outcomes:

After learning the course the students should be able to

| Sr. No. | CO statement   | Marks % weightage |
|---------|--|-------------------|
| CO-1    | apply the knowledge of digital number systems, Boolean algebra, and logic gates for logic function minimization. | 25                |
| CO-2    | design and analysis combinational and sequential circuits  | 30                |
| CO-3    | design synchronous and asynchronous circuits FSM.  | 20                |
| CO-4    | comprehend the digital logic families and PLDs   | 10                |
| CO-5    | implement digital circuits using Verilog based VLSI design flow  | 15                |

### List of Experiments:

1. Getting familiar with various digital integrated circuits of different logic families. Study of data sheet of these circuits and see how to test these circuits using Digital IC Tester.
2. Digital IC Testers and Logic State Analyzer as well as digital pattern generators should be demonstrated to the students.



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## Bachelor of Engineering

### Subject Code: 3131102

3. Configure transistor as logic gates and Digital ICs for verification of truth table of logic gates
4. Configuring NAND and NOR logic gates as universal gates.
5. Implementation of Boolean Logic Functions using logic gates and combinational circuits. Measure digital logic gate specifications such as propagation delay, noise margin, fan in and fan out.
6. Study and configure various digital circuits such as adder, subtractor, decoder, encoder, code converters.
7. Study and configure multiplexer and demultiplexer circuits.
8. Study and configure flip-flop, registers and counters using digital ICs. Design digital system using these circuits.
9. Perform an experiment which demonstrates function of 4 bit or 8 bit ALU.
10. Introduction to HDL. Use of Verilog HDL in simulation of digital circuits studied in previous sessions using integrated circuits. Illustrative examples using FPGA or CPLD boards.

#### Design based Problems (DP)/Open Ended Problem:

1. Design of combinational lock circuits with varying number of bits (For example 4, 8 .....)
2. Design of various types of counters.
3. Design of Arithmetic and Logic Unit using digital integrated circuits.
4. Design of digital integrated circuit tester
5. Measurement of logic family specifications.
6. Design project for example digital clock, digital event counter, timers, and various multi-vibrator Circuits, small processor, ports or scrolling display.

A student and faculty may choose any other such problem which includes the concept used in the course.

#### Major Equipments:

1. Pattern Generators
2. Logic State Analyzers
3. Digital Storage Oscilloscopes
4. Digital Integrated Circuits Tester.
5. Complete Bread Board Systems, switches and I/O indicators, multimeters, pulse, square wave generators and display facility.

#### List of Open Source Software/learning website:

1. Web packages for HDL, GHDL, Free HDL
2. PSpices and NGSpice
3. Xcircuit and Scilab
4. NPTEL website and IITs virtual laboratory



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**Bachelor of Engineering**  
**Subject Code: 3131103**  
**Subject Name: NETWORK THEORY**  
**Semester III**

**Type of course:** Passive circuit analysis and synthesis

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

**Rationale:** Students of EC 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 course which is 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 |
|-----------------|---|---|---------|-------------------|----|-----------------|-------|-------------|
| L               | T | P |         | Theory Marks      |    | Practical Marks |       |             |
|                 |   |   |         | ESE(E)            | PA | ESE (V)         | PA(I) |             |
| 4               | 0 | 2 | 5       | 70                | 30 | 30              | 20    | 150         |

**Content:**

| Sr. No. | Content  | Total Hrs | % Weightage |
|---------|--|-----------|-------------|
| 1       | Circuit Variables and Circuit Elements and Sources: E.M.F, Potential and Potential Difference, Current and Current Density, Ideal and Practical Voltage and Current Sources. Conversion from one source into other. Internal Impedance of voltage and current source relative to load. Two-terminal Capacitance – Two-terminal Inductance- Independent and Dependent Electrical Sources –Power and Energy Relations for Two-terminal Elements – Classification of Two-terminal Elements – Multi-terminal Circuit Elements, Dot Convention. | 3         | 6           |
| 2       | Nodal Analysis and Mesh Analysis of resistive Circuits:<br>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 containing Independent Voltage Sources - Mesh Analysis of Circuits Containing Dependent Sources.  | 5         | 10          |
| 3       | Circuit Theorems and Their Applications in Electric Networks:<br>Linearity of a Circuit and Superposition Theorem-Substitution Theorem-Compensation Theorem - Thevenin's Theorem and Norton's Theorem - Determination of Equivalent for Circuits with Dependent Sources -Reciprocity Theorem - Maximum Power Transfer Theorem - Millman's Theorem-Duality Theorem-Duality between Electricity and Magnetism.   | 6         | 12          |
| 4       | Time domain response of First order RL and RC circuits:  | 4         | 8           |



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|              |  |    |     |
|--------------|--|----|-----|
|              | Mathematical preliminaries – Source free response –DC response of first order circuits – Superposition and linearity – Response Classifications – First order RC Op Amp Circuits.  |    |     |
| 5            | Time domain response of Second order linear circuits:<br>Discharging of a Capacitor through an inductor – Source free second order linear networks – second order linear networks with constant inputs.  | 4  | 8   |
| 6            | Initial conditions:<br>Initial conditions in elements, procedure for evaluating initial conditions, Solution of circuit equations by using Initial Conditions.   | 4  | 8   |
| 7            | Laplace Transform Analysis and Circuit Applications:<br>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.  | 6  | 10  |
| 8            | Laplace Transform Analysis and Transfer Function Applications:<br>Poles, Zeros and the s-plane- Classification of Responses – Computation of sinusoidal steady state response for stable networks and systems.   | 5  | 8   |
| 9            | Two –Port Networks :<br>One port networks – 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.  | 8  | 12  |
| 10           | Introduction to Network Topology:<br>Linear Oriented Graphs (Connected Graph, Subgraphs and Some Special Subgraphs) - 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 $Q_a$ - Orthogonality relation between Cut-set matrix and Circuit matrix - The Fundamental Cut-set Matrix of - Relation between of , A and Bf) - Kirchhoff's Laws in Fundamental Cut-set formulation - Tie set -Tie set Matrix (F-loop matrix)- Tie set schedule. | 7  | 12  |
| 11           | Introduction to Passive Network Synthesis:<br>Introduction of Hurwitz Polynomial, Positive Real Function (PRF), Elementary Synthesis Procedure.  | 4  | 6   |
| <b>Total</b> |  | 56 | 100 |



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Suggested Specification table\* with Marks (Theory):

| Distribution of Theory Marks |         |         |         |         |         |
|------------------------------|---------|---------|---------|---------|---------|
| R Level                      | U Level | A Level | N Level | E Level | C Level |
| 10                           | 10      | 20      | 20      | 5       | 5       |

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

\*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 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:

After learning the course the students should be able to:

| Sr. No. | CO statement  | Marks % weightage |
|---------|---|-------------------|
| CO-1    | analyse passive circuits using various networks theorems                          | 50                |
| CO-2    | analyze and evaluate the transfer functions using classical and transform methods | 20                |
| CO-3    | evaluate two port parameters for the given two port network configurations .      | 10                |
| CO-4    | comprehend the basics of network topologies ,graph theory and network synthesis   | 10                |
| CO-5    | synthesis the knowledge of Circuit theory to electrical and electronic circuits   | 10                |

### 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 RL 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)





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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 Equipments:

- i. Function Generator
- ii. Oscilloscope
- iii. Digital Multi-meter
- iv. DC Power Supply (0-30 V)

### List of Open Source Software/learning website:

Multisim, SCILAB, PSpice, NGSpice (Open Source Software)

GTUQuestionPapers.com