# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code:3141007**
**SUBJECT NAME:Professional Ethics**
**Semester IV**

**Type of course:**

**Prerequisite: NA**

**Rationale:**

**Teaching and Examination Scheme:**

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

**Content:**

| Sr. No. | Content | Total Hrs |
|---|---|---|
| 1 | Concepts and theories of Business Ethics: Definitions of Ethics, Personal ethics and Business ethics, Morality and law, How are moral standards formed? Religion and Morality, Morality, Etiquette and Professional codes, Indian Ethical Traditions. | 6 |
| 2 | Business Ethics: Principles of personal Ethics, Principles of Professional ethics, Evolution of Ethics Over the years, Honesty, Integrity and Transparency are the touchstones of Business Ethics, Distinction Between Values and Ethics, Roots of unethical Behaviour, Ethical Decision – Making | 6 |
| 3 | Ethical Dilemmas, Sources and Their resolutions: What is an Ethical Dilemma, Sources of Ethical Behaviour, Code of Personal Ethics for Employees, How to Resolve an Ethical Problem, How to Resolve Ethical Dilemmas. | 5 |
| 4 | Ethical Decision – marking in Business: Ethical Models that Guide Decision making, Which Approach to use, Ethical Decision Marking with Cross – holder conflicts and competition, Applying Moral Philosophy to Ethical Decision Making, Kohlberg's Model of Cognitive Moral Development, Influences on Ethical Decision Making, Personal values and Ethical Decision Marking | 10 |
| 5 | Individual factors: Moral Philosophies and values – Moral Philosophy defined, Moral philosophies, Applying Moral Philosophy to Ethical decision Making, Cognitive moral Development, White – Collar Crime, Individual factors in Business Ethics | 9 |
| 6 | Human Values for Indian Managers, Lessons from Ancient Indian Education system, The law of Karma, Quality of Working life, Ethics of Vivekananda, Gandhiji, Aurobindo and Tagore. | 9 |

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**

**Subject Code:3141007**

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

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level | C Level |
| 25 | 20 | 10 | 25 | 20 | 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 slightly from above table.

**Reference Books:**


1. Business Ethics by AC Fernando
2. Business Ethics by Ferrell, Fraedrich and Ferrell.
3. Ethics in Management and Indian Ethos by Biswanath Gosh


**Course Outcomes: After learning the course the students will able to**

| Sr. No. | CO statements | Marks %Weightage |
|---|---|---|
| **CO-1** | Awareness of types of ethical challenges and dilemmas confronting members of a range of professions (business, media, police, law, medicine, research) | 25 |
| **CO-2** | Identify and describe relevant theoretical concepts related to professional ethics in engineering | 20 |
| **CO-3** | Understand the basic perception of profession, professional ethics, various moral issues & uses of ethical theories | 20 |
| **CO-4** | Distinguish among morals, values, ethics, and the law and to explore how they each impact engineering practice | 25 |
| **CO-5** | Apply learning from Indian history and ethos to ethical practices in engineering. | 10 |

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3141008**
**Semester – IV**
**Subject Name: Microprocessor and Microcontroller**

**Type of course:** Professional Core Course

**Prerequisite:** Digital System Design

**Rationale:**
The knowledge of microcontroller is very essential for a UG student of Electronics and Communication Engineering as the world is migrating towards automation rapidly in each and every fields. The students studying the subject are supposed to learn the architecture and programming of typical microcontroller. Students will be taught the basic use of an assembly as well as embedded C programming environment to control peripheral devices. Students will also understand the interfacing of various peripheral elements with microcontroller to design an automated system. The course will cover introduction to basic 8085 microprocessor as well as AVR, 8-bit Microcontroller in detail with sufficient exposure to design an embedded system.

**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 | % Weightage |
|---|---|---|---|
| 1 | **Fundamentals of Microprocessors:** History of microprocessor and microcontrollers, Difference between microprocessors and microcontrollers and Applications of microcontrollers, Architectural of 8-bit 8085 microprocessor, Pin details and functional operation of 8085, Memory and I/O interfacing. Role of microcontrollers in embedded Systems. Overview of the AVR family | 8 | 15% |
| 2 | **Architecture and instruction set of 8-bit AVR Microcontroller:** AVR Microcontroller architecture: Registers, AVR status register, Memory Space, ATmega32 pin-configuration & function of each pin, Addressing mode and instruction set of AVR microcontroller, Data transfer, Arithmetic, Logic and Compare, Rotate and Shift, Branch and Call instructions, Bit manipulation instructions | 6 | 15% |
| 3 | **AVR Assembly and C Programming:** . AVR data types and assembler directives, AVR assembly language programs, | 14 | 25% |

| | | | |
|---|---|---|---|
| | AVR I/O Port Programming, Time delay loop, BCD, ASCII conversion Program, Look-up table, Bit addressability, MACROs, Pros and cons of C and assembly language programming, Data types, Intex Hex file format, Simple C programs for general purpose I/O and bit addssablity. | | |
| **4** | **AVR on-chip peripherals and its programming:** General purpose I/O Ports, Timers, Interrupts, serial port, Serial port Interfacing protocols, SPI, I2C, UART. Assembly and C Language programming for peripherals. | 12 | 20% |
| **5** | **Device interfacing and its programming:** LCD and GLCD interfacing, Keyboard Interfacing, TFT interfacing, ADC, DAC and sensor interfacing, Relay, Opto-isolator and Stepper Motor Interfacing, Industrial servo interfacing, Input capture and Wave Generator, PWM programming and DC motor control, SPI protocol and Display interfacing, I2C Protocol and RTC interfacing. Assembly and C Programming | 12 | 25% |

**Suggested Specification table with Marks (Theory): (For BE only)**

| **Distribution of Theory Marks** | | | | | |
|---|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level | C Level |
| **20** | **20** | **25** | **15** | **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. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi,"*The AVR Microcontroller and Embedded Systems", Using Assembly and C*, Pearson Education, 1st Edition, 2012.
2. Dhananjay Gadre, *"Programming and Customizing the AVR Microcontroller*", TMH, 1st Edition, 2001.
3. R. S. Gaonkar, ", Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996

**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Explain the architecture of 8085 microprocessor and AVR 8-bit | 15 |

| | | |
|---|---|---|
| | Microcontroller | |
| CO-2 | Differentiate microprocessor and microcontroller and Describe the importance and function of each pin of AVR ATmega32 Microcontroller | 15 |
| CO-3 | Learn and analyze assembly language programs for AVR Microcontroller | 25 |
| CO-4 | Develop embedded C language programs for AVR Microcontroller | 25 |
| CO-5 | Interface I/O peripheral devices with AVR microcontroller to develop embedded system | 20 |

**List of Experiments:**

Understand Arduino open source hardware and programming environment and write program to blink LED using Arduino instructions, C language & Assembly language.

2. Interface Digital/Analog input output interfacing module with Arduino board and write programs related to I/O module

3. Generate PWM waveform and change intensity of LED connected with Arduino board.

4. Write and execute Arduino program for serial communication. Transmit temperature value through serial communication and store it in spreadsheet or text file

5. Write and execute Arduino program to display message and numbers on LCD, GLCD and TFT.

6. Write and execute Arduino program to read analog value. Sense temperature using LM35 sensor and display temperature value on LCD

7. Write assembly language programs for ATMega32 Microcontroller and simulate using ATMEL Studio

8. Understand hardware of ATMega32 Kit. Write program to flash LEDs, Read status of switches, Display count values on seven segment display. Upload programs in the kit one by one and execute.

9. Write program to read switch status and display it on LCD. Write program in Assembly as well as C language.

10. Write program to rotate stepper motor in half step and full step mode in Assembly as well as C language. Simulate program using PROTEUS software

11. Write program to rotate DC motor in clockwise and anti-clockwise direction in Assembly as well as C language. Simulate program using PROTEUS software.

12. Observe waveforms of I2C and SPI communication and understand I2C and SPI protocol

13. Write Arduino program to receive IR Signal from IR remote and operate Electrical device based on switch pressed.

14. Report of Student Mini Project based on microcontroller (Student will select mini project based on real life challenge identified through Shodh-Yatra)

**Major Equipment/software:**

- Arduino UNO or Nano board
- ATMega32 Kit
- Proteus or equivalent microcontroller simulation software
- ATMEL Studio 7.0

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

- NPTEL Video lecture on AVR microcontroller**:** **https://nptel.ac.in/courses/108105102/52**
- Arduino software

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3141009**
**Semester – IV**
**Electromagnetic Theory**

**Type of Course:** Electromagnetic Theory and Wave Propagation

**Prerequisite:** Basic knowledge of vector calculus, Electric and Magnetic fields and its laws.

**Rationale:** This course provides strong foundation for understanding the fundamental principles and laws of electromagnetism to understand transmission, radiation and propagation theory. Students can understand the physical interpretation and application of various laws and theorems of electric and magnetic fields. The students can also understand the principles of transmission lines.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| L | T | P | C | Theory Marks | | Practical Marks | | |
| | | | | ESE (E) | PA (M) | ESE (V) | PA (I) | |
| 4 | 0 | 0 | 4 | 70 | 30 | 0 | 0 | 100 |

| Sr. No. | Course Content | Teach -ing hours | Module weightage |
|---|---|---|---|
| 1 | **Review of Vector Calculus**<br>Over view of Vector Algebra, Dot Product, Cross Product, Coordinate Systems, Conversion of a Vector from One Coordinate system to another, Del Operator, Divergence, Gradient and Curl. | **05** | **10%** |
| 2 | **Overview of Electrostatic & Steady Magnetic Fields**<br>Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume Charge Distributions, Gauss law, Divergence Theorem, Electric potential, Potential Gradient, Biot-Savart Law, Magnetic Flux and Magnetic Flux Density, Ampere's Circuital Law, , Stoke's theorem Scalar and Vector Magnetic potentials, Lorentz Force equation. | **12** | **20%** |
| 3 | **Time Varying Fields and Maxwell's Equations (6 Hours)**<br>Faraday's Law, Displacement Current, Maxwell's Equations in Point Form, Maxwell's Equations in Integral Form, The Retarded Potentials. | **09** | **20%** |
| 4 | **Uniform Plane Wave (6 Hours)**<br>Wave Propagation in Free Space, Wave Propagation in Die-Electric, The Poynting Vector and Power Considerations, Propagation in Good Conductors: Skin Effect, Wave Polarization. | **12** | **20%** |
| 5 | **Plane Waves at Boundaries and in Dispersive Media**<br>Reflection of Uniform Plane Wave at Normal Incidence, Standing Wave Ratio, Wave Reflection from Multiple Interfaces, Plane Wave Propagation in General Directions, Plane Wave Reflection at Oblique Incidence Angle. | **10** | **15%** |
| 6 | **Transmission Lines**<br>Transmission lines parameters, Equations of Voltage and Current on TX line, Propagation Constant and Characteristic Impedance, Input Impedance, and Reflection Coefficient and VSWR, Power Transfer, Lossless and Distortionless Transmission Lines, Smith Chart, Applications of Transmission Lines, Impedance | **12** | **15%** |

| | | | |
|---|---|---|---|
| | Matching: Single and Double Stub Lines. | | |

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

| Distribution of Theory Marks | | | | | |
|---|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level | C Level |
| **05** | **20** | **10** | **20** | **10** | **05** |

**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 W. Hayt, "Engineering Electromagnetics",Seventh Edition, McGraw Hill Education, 2012.
2 M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
3 R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
4 A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
5 Electrimagnetics Fields and Waves Third Edition by Simon Ramo, John Whinnery Wiley India Edition.
6 Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
7 E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India.

**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | | |
| CO-2 | | |
| CO-3 | | |
| CO-4 | | |
| CO-5 | | |

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

1. CD available with first reference book.
2. nptel.ac.in

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3141010**
**Semester – IV**
**Electronic Measurement Laboratory**

**Teaching and Examination Scheme:**

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

**List of Experiments**

1. Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
2. Designing AC bridge Circuit for capacitance measurement
3. Designing signal Conditioning circuit for Pressure Measurement
4. Designing signal Conditioning circuit for Temperature Measurement
5. Designing signal Conditioning circuit for Torque Measurement
6. Designing signal Conditioning circuit for Strain Measurement
7. Experimental study for the characteristics of ADC and DAC
8. Error compensation study using Numerical analysis using MATLAB (regression)

**Course Outcomes:**

At the end of this course students will demonstrate the ability to

1. Design and validate DC and AC bridges
2. Analyze the dynamic response and the calibration of few instruments
3. Learn about various measurement devices, their characteristics, their operation and their limitations
4. understand statistical data analysis
5. Understand computerized data acquisition

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3141002**
**Semester – IV**
**ANALOG CIRCUIT DESIGN**

**Type of Course: C**ircuit Design and Analysis

**Prerequisite:** Basic knowledge of electronic active and passive components and low frequency circuit analysis techniques etc.

**Rationale:** This course aims to familiarize students with high frequency analysis of BJT circuits, various oscillators, differential amplifier, op-amp and its applications, and op-amp based filter circuits.

**Teaching and Examination Scheme:**

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

**Content:**

| Sr. No. | Topics | Teaching Hrs. | Module Weightage |
|---|---|---|---|
| 1 | **Transistor at High Frequencies:** Hybrid –pi CE Transistor Model, Hybrid –pi Conductance, Hybrid –pi Capacitances, Validity of Hybrid –pi Model, Variation of Hybrid –pi Parameters, CE Short-Circuit Current Gain, Current Gain with Resistive Load, Single-Stage CE Transistor Amplifier Response, Gain-Bandwidth Product, Emitter Follower at High Frequencies | **8** | **15** |
| 2 | **Oscillators:** Sinusoidal oscillators, Phase-shift oscillator, Resonant circuit oscillators, A general form of oscillator circuit, Wien bridge oscillator, Crystal oscillators, Frequency stability | **6** | **12** |
| 3 | **Feedback Amplifiers:** Classification of Amplifiers, Feedback Concept, Transfer Gain with Feedback, General Characteristics of Negative Feedback Amplifiers, Input Resistance, Output Resistance, Method of Analysis of a Feedback Amplifier, Voltage Series Feedback, A Voltage Series Feedback Pair, Current Series Feedback, Current Shunt Feedback, Voltage Shunt Feedback | **8** | **15** |
| 4 | **Operational Amplifiers:** The Basic Operational Amplifier, Transistor based Differential Amplifier, The Emitter –Coupled Differential Amplifier. **Linear Analog Systems:** Basic Operational Amplifier Applications, Differential DC Amplifier, Stable AC-Coupled Amplifier, Analog Integration and Differentiation. **Non-Linear Analog Systems:** Comparators, Sample-and-Hold Circuits, Precision AC/DC Converters, Logarithmic Amplifiers, Waveform Generators, | **8** | **15** |

| | | | |
|---|---|---|---|
| | Regenerative Comparator (Schmitt Trigger), Emitter-Coupled Logic (ECL) | | |
| **5** | **Specialized ICs and its Applications:**<br>i) 555 Timer and its applications: Block diagram, Monostable and Astable multivibrator, Applications as Frequency divider, Square wave generator<br>ii) Phase Locked Loops and its Applications: Block diagram and operation, Applications as Frequency Multiplier, Frequency Shift Keying<br>iii) Design of Power Supply: Simple op-amp voltage regulator, Three terminal voltage regulators, Fixed and adjustable voltage regulators (78XX, LM317), Heat sink, Dual power supply (LM320, LM317), Basic switching regulator and its characteristics | **6** | **13** |
| **6** | **Power Circuits and Systems:**<br>Class A large Signal Amplifiers, Second Harmonic Distortion, Higher –Order Harmonic Generation, Transformer Coupled Audio Power Amplifier, Efficiency, Push-Pull Amplifiers, Class B Amplifiers, Class AB Operation | **8** | **15** |
| **7** | **Active Filters:**<br>Ideal Responses, Approximate Responses, Passive Filters, First-Order Stages, VCVS Unity –Gain Second-Order Low-Pass Filters, Higher-Order Filters, VCVS Equal-Component Low-Pass Filters, VCVS High-Pass Filters, MFB Bandpass Filters, Bandstop Filters, The All-Pass Filter, Biquadratic and State-Variable Filters. | **8** | **15** |

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

| **Distribution of Theory Marks** | | | | |
|---|---|---|---|---|
| R Level | U Level | A Level | N Level | E Level |
| 10 | 15 | 15 | 15 | 15 |

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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. Electronics Device and Circuits by Jacob Milman, Christos C. Halkias, Chetan D. Parikh, Tata Macgraw Hill Publication [Second Edition].
2. Electronics Principles by Albert Malvino [seventh Edition]
3. Op-amps and Linear Integrated Circuits, Ramakant A. Gaikwad, Fourth Edition, PHI.

**Course Outcomes:**

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

1. To analyse transistor circuits at high-frequency as well as various application circuits such as Oscillator, Differential Amplifier, etc.
2. To analyse various feedback topologies.
3. To analyse and design various application circuits using op-amp and 555 timers including active filters.
4. To analyse various power amplifier circuits and power supply regulator.
5. To analyse operation of PLL and other specialized application circuits.

**List of Experiments:**

1. To build transistor based RC phase shift oscillator circuit, and measure and verify its frequency of operation.
2. Measurement of input and output offset voltage of 741 ICs.
3. To configure op-amp in voltage follower mode and to measure its slew rate.
4. To configure op-amp in inverting and non-inverting amplifier mode and measure their gain and bandwidth.
5. To prepare precision rectifier using op-amp and verify its operation using measurements.
6. To prepare full-wave rectifier using op-amp and verify its operation using measurements.
7. To measure PSRR and CMRR of given op-amp.
8. To design Schmitt trigger circuit using op-amp and take measurements.
9. To design, build astable and monostable multivibrators using 741 IC and verify their operation using measurements by observing waveforms.
10. To design, build and obtain the frequency responses of first order low pass and band pass active filters.
11. To build op-amp based Weign bridge oscillator circuit, and measure and verify its frequency of operation.
12. Design the following amplifiers:
    1) A unity gain amplifier
    2) A non-inverting amplifier with a gain of 'A'
    3) An inverting amplifier with a gain of 'A'
        a) Apply a square wave of fixed amplitude and study the effect of slew rate on the three types of amplifiers.
13. Design and test the integrator for a given time constant.
14. Design a second order butter-worth band-pass filter for the given higher and lower cut-off frequencies.
15. Design and test a notch filter to eliminate the 50Hz power line frequency.
16. Design and test a function generator that can generate square wave and triangular wave output for a given frequency.
17. Design and test voltage controlled oscillator for a given specification (voltage range and frequency range).
18. Design and test a Low Dropout regulator using op-amps for a given voltage regulation characteristic and compare the characteristics with standard IC available in market.
19. Design and test an AGC system for a given peak amplitude of sine-wave output.
20. Design and test a PLL to get locked to a given frequency 'f'. Measure the locking range of the system and also measure the change in phase of the output signal as input frequency is varied within the lock range.

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

1. Design single stage CE amplifier for high frequency.
2. Design Wien bridge oscillator for a particular frequency.
3. Design voltage series feedback amplifier with op-amp.
4. Design averaging amplifier with op-amp.
5. Design an instrumentation amplifier for particular application.
6. Design zener diode tester with op-amp.
7. Design zero crossing detector circuit using op-amp.
8. Design antilog amplifier.
9. Design touch switch using 555 IC.
10. Design two different color driver using 555 IC.
11. Design a buzzer to indicate end of the class using 555 IC.
12. Design adjustable voltage regulator using LM317 IC.
13. Design 2nd order High Pass Butterworth filter using op-amp.

**Major Equipments and Components:**
C.R.O., Function Generator, Power Supply, Multi-meter, Digital Storage Oscilloscope, Experimental Trainer Kits (e.g. Analog System Lab Kits, Operational Amplifier Trainer Kits, Linear IC Trainer, etc. ), Bread Board, General Purpose PCB, 741/082 op-amp, 555 Timer, Resistors, Capacitors, Diodes, etc.

**List of Open Source Software/learning website:**
Ng-spice/Multisim
www.nptel.com

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3141005**

**SUBJECT: SIGNAL AND SYSTEMS**
**SEMESTER – IV**

**Type of course:** Foundation of signals and systems for electrical, electronics and electronics and communication engineering

**Prerequisite:** Differential equations and difference equations, Laplace Transform, Electrical circuits and networks,.

**Rationale:** The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing. The students will learn basic continuous time and discrete time signals and systems. Student will understand application of various transforms for analysis of signals and systems both continuous time and discrete time. Students will also explore effect of sampling on spectrum of signal.

**Teaching and Examination Scheme:**

| Teaching Scheme | | | Credits | Examination Marks | | | | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | | | | Theory Marks | | Practical Marks | | |
| L | T | P | C | ESE(E) | PA | ESE (V) | PA(I) | |
| 3 | 0 | 2 | 5 | 70 | 30 | 30 | 20 | 150 |

**Content:**

| Sr. No. | Content | Total Hrs | % Weightage |
|---|---|---|---|
| 1 | **Introduction to Signals & Systems:** Basic definitions of signals and systems, Basic elementary signals, Classification of signals and systems. Signal operations and properties. Basic continuous time signals, Basic system properties, Case study of different signals | 4 | 10 |
| 2 | **Behaviour of Continuous time (CT)& Discrete Time(DT) Linear Time Invariant (LTI) System:** Impulse response characterization and convolution for CT- LTI and DT-LTI systems, Properties of LTI systems,LTI systems characterized by Differential and difference equations | 12 | 25 |
| 3 | **Introduction to Fourier Series, Fourier Transform:** Fourier Series Representation of periodic Signals, Fourier series, Waveform Symmetries, Calculation of Fourier Coefficients, Frequency spectrum of aperiodic signals, Fourier Transform, Relation between Laplace Transform and Fourier Transform. Properties of Continuous Time Fourier transform. System Analysis using Fourier Transform. Introduction to DTFT and DFT. | 12 | 25 |
| 4 | **Z Transform:** The z-Transform, Convergence of z-Transform, , Properties of z-Transform, Inverse z-Transform , LTI System analysis from Linear Constant Coefficient Difference Equations using z-Transform | 12 | 25 |
| 5 | **Sampling & Reconstruction:** Representation of digital signals, The Sampling Theorem, Sampling with a zero order hold, Reconstruction of a signal from its samples using interpolation, Aliasing and its effects. | 5 | 15 |
| **Total** | | **45** | **100** |

# GUJARAT TECHNOLOGICAL UNIVERSITY

**Bachelor of Engineering**
**Subject Code: 3141005**

**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.*

**Books:**


1. Signal and Systems By Anand Kumar, 3rd Edition, PHI
2. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall
3. Signals and Systems by K. Gopalan, Cengage Learning (India Edition)
4. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications
5. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley-India Publications
6. Linear Systems and Signals by B.P.Lathi, Oxford University Press
7. Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education
8. Digital Signal Processing Fundamentals and Applications by Li Tan, Elsevier, Academic Press


**Course Outcomes:**

| Sr. No. | CO statement | Marks % weightage |
|---|---|---|
| CO-1 | Understand about various types of signals, classify them, analyze them, and perform various operations on them. | |
| CO-2 | Understand about various types of systems, classify them, analyze them and understand their response behavior. | |
| CO-3 | Appreciate use of transforms in analysis of signals and system. | |
| CO-4 | Carry simulation on signals and systems for observing effects of applying various properties and operations. | |
| CO-5 | Create strong foundation of communication and signal processing to be studied in the subsequent semester | |

**List of Experiments:**

1. Generations and capturing various continuous time signals from sensors.
2. Generation and capturing of discrete time signals and plot them.
3. Discretization using different sampling rate and observing aliasing effect.
4. Observing the effects of lower sampling rate and higher sampling rate on CT signal.
5. Performing various operations on the signal using circuits and computational software.
6. Using digital circuit building block to perform operations on signals.
7. Simulation of continuous time LTI system.
8. Simulation of discrete time LTI systems.

9. Obtaining impulse response of the systems.
10. Computing FT and DTFT of the CT signals and DT sequences.

**Open Ended Problems**

1. Design of active noise removal / cancellation circuit.
2. Design of digital building blocks to perform various operations on discrete time sequences and signals.
3. Design of efficient and accurate signal converter.
4. Design of sample and hold circuits
5. Design of anti aliasing filter.

**Major Equipments:**

Computers, analog circuit blocks, digital circuit blocks, signal generators, digital storage oscilloscope and spectrum analyser

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

| | |
|---|---|
| 1 | SEQUEL |
| 2 | SCILAB |
| 3 | NPTEL Videos |
| 4 | MIT open course ware website |
| 5 | MATLAB |