Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Electronics Engineering
B.Tech. Electronics and Communication Engineering

Minor Courses:

B. Tech. Minor in Electronics Engineering (for Mechanical, Civil, and Chemical Engineering students)				
Sr. No.	**Subject**	**Code**	**Scheme**	**Credits**
1	Analog Electronics	EC2XX	3-0-2	04
2	Digital Electronics and Microcontrollers	EC3XX	3-0-2	04
3	Communication and Signal Processing	EC3XX	3-0-2	04
4	Sensors and Instrumentation	EC4XX	3-0-2	04

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Electronics Engineering
B.Tech. Electronics and Communication Engineering

B.Tech.2 Semester IV ANALOG ELECTRONICS EC2XX	Scheme	L	T	P	Credit
		3	0	2	04

1. Course Outcomes (COs):

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

CO1	Understand the basics of semiconductors and Diodes
CO2	Explain Transistors and MOSFETs.
CO3	Discuss Optoelectronic devices
CO4	Analyse working of Rectifiers, filters, and regulators circuits
CO5	Classify and analyse Amplifiers and Oscillators circuits
CO6	Illustrate OP-AMP circuits and 555 Timer applications.

2. Syllabus:

- **SEMICONDUCTOR DIODES AND APPLICATIONS** **(09 Hours)**

Quantitative theory of PN diode, volt-ampere characteristics, and its temperature dependence, narrow-base diode, transition and diffusion capacitance of p-n junction diodes, breakdown of junctions on the reverse bias, small signal models of the diode, PN diode Application as Rectifier, Half Wave Rectifier, Centre Tap and Bridge Rectifier, Filter circuits, C, LC and pie filter with circuit Diagram and waveforms. Zener Diode theory, Construction, Operation with forward and reverse VI characteristics, Zener Voltage Regulator, construction and application of Schottky and Varactor Diodes.

- **TRANSISTORS AND MOSFETs** **(10 Hours)**

Transistors- definition, terminals, types, symbols, formation of NPN and PNP, ratings. Transistor biasing- definition, importance, list types, stabilization, thermal runaway, heat sink, and voltage divider method. List configurations and applications. Alpha and Beta- definitions, relation. CE input and output characteristics- cut off, saturation, and active regions. Transistor as a switch. List applications. FET- definition, types. MOSFET- definition, types, symbols. N type enhancement mode- construction, working, characteristics, switch. List applications and ratings, BJT, Differentiate BJT and MOSFET.

- **SPECIAL PURPOSE DIODE** **(05 Hours)**

Electron emission– types, applications. Symbols, working and applications of–photo diode, opto isolator, photo voltaic cell, LED, LDR, LCD, opto coupler.

- **AMPLIFIERS AND OSCILLATORS** **(10 Hours)**

Amplifier- definition, faithful amplification, classification based on configuration, power, and frequency. Transistor CE amplifier with biasing. Working of class A, B, C, and Push pull amplifier. Two stage RC coupled amplifier-working, gain in dB, frequency response. Feedback- definition, types, advantages and disadvantages, applications. Oscillators- definition, classification, LC tank circuit, criteria. RC phase shift and crystal oscillator- working, applications.CRT- construction, working and applications

- **OPERATIONAL AMPLIFIER** **(11 Hours)**

Differential amplifier-Dual input balanced output differential amplifier, block diagram of typical Op-Amp, schematic symbol, interpreting data sheet, the ideal Op-Amp, equivalent circuit of an

	Op-Amp, Op-Amp Parameters-Input Impedance, Output impedance, input offset voltage, Open Loop Voltage gain, input bias current, slew rate open loop Op-Amp configurations **Application:** Voltage series feedback amplifier, Voltage shunt feedback amplifier, DC and AC amplifiers, summing, scaling and averaging amplifiers, voltage to current converter, integrator, differentiator, basic comparator, zero-crossing detector, Schmitt trigger	
	• **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY**	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	
3.	**List of Practicals:**	
	1. To study the Active/Passive Components and Various Instruments 2. To study and plot the volt-ampere characteristics of pn junction diode in Forward and Reverse bias and obtain the cut-in voltage. 3. To study and design Half Wave Rectifier with and without filter and calculate its ripple factors. 4. To study and design Zener diode based voltage regulator and calculate the line and load regulation. 5. To study and design Full Wave Rectifier with and without filter and calculate its ripple factors. 6. To study and plot the I/P and O/P characteristics of BJT / MOSFET 7. To study and design single RC coupled Amplifier using BJT/MOSFET. 8. To study and design Inverting & Non Inverting Amplifier using Op-Amp 9. To study and design Adder/Subtractor using Op-Amp 10. To study and Design RC Phase Shift Oscillator using BJT/op-amp 11. To study and Design square wave generator using op-amp 12. Minor Project	
4.	**Reference Books:**	
	1. Electronics Principles and applications by Charles A Schuler and Roger L Tokhiem, Sixth Edition, Mc. Graw Hill , 2008. 2. Electronics Principles by Malvino, Mc. Graw Hill, Third edition. 2000. 3. Electronics Devices and Circuits by Allan Mottershed, PHI Learning Pvt. Ltd., First Edition. 4. Electronics Analog and Digital by I. J. Nagrath, PHI Learning Pvt. Ltd., 2013 Edition. 5. Linear Integrated Circuits by Ramakant A. Gayakwad, PHI Learning Pvt. Ltd., Fourth Edition	

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B.Tech.2 Semester IV DIGITAL ELECTRONICS AND MICROCONTROLLERS EC3XX	Scheme	L	T	P	Credit
		3	0	2	04

1. Course Outcomes (COs):

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

CO1	Apply Boolean algebra to understand binary logic and logic circuits.
CO2	Formulate combinational logic problems and solve using truth table. Optimize using K-map and other equivalent techniques
CO3	Design and realize synchronous Sequential logic circuits
CO4	Understand operation counters, registers and memory
CO5	Investigate organization of computer and describe internal architecture of 8051microcontroller
CO6	Develop Assembly programs of microcontroller to implement algorithms

2. Syllabus:

- **BOOLEAN ALGEBRA AND SIMPLIFICATION** **(06 Hours)**

Basic Logic Operation and Logic Gates, Truth Table, Basic Postulates and Fundamental Theorems of Boolean Algebra, Minterms and Maxterms, Standard Representations of Logic Functions- SoP and PoS Forms, Introduction to K maps, Simplification of Boolean Functions using K-Map.

- **COMBINATIONAL LOGIC CIRCUITS** **(09 Hours)**

Full adder and Full subtractor design, Binary Parallel Adder, Carry Look-ahead Adder, Magnitude comparator, BCD adder, Encoder Priority Encoder, Decoder, Multiplexer and De-multiplexer Circuits, Implementation of Boolean Functions using Decoder and Multiplexer, Arithmetic and Logic Units.

- **LATCHES AND FLIP-FLOPS** **(08 Hours)**

Cross Coupled SR Flip-Flop Using NAND or NOR Gates, Clocked Flip-flops, D-Types and Toggle Flip-flops, Truth Tables and Excitation Tables for Flip-flop. Master Slave Configuration, Edge Triggered and Level Triggered Flip-flop, Flip-flop with Preset and Clear.

- **SEQUENTIAL LOGIC CIRCUIT** **(08 Hours)**

Introduction to State Machine, Mealy and Moore Model, State Machine Notation, State Diagram, State Table, Flip flop excitation table, Design procedure of clocked sequential circuits.

Registers with parallel load, Shift Left and Shift Right Register, Serial-in-Parallel-Out(SIPO) and Parallel-In-Serial-Out(PISO), Ripple counter, and synchronous counters.

- **INTRODUCTION TO MICROCONTROLLERS** **(06 Hours)**

Internal Organization of Computer, Buses of the computing system, CPU with RAM and ROM, ALU), Introduction to 8051 8-bit microcontroller, Internal architecture of 8051, and Addressing modes. A brief overview of I/O Ports, Timers, and Serial communication. Advanced microcontrollers.

	• **8051 ASSEMBLY LANGUAGE PROGRAMMING**	**(08 Hours)**
	8051 data types and registers, Instructions for moving data, Arithmetic and Logical instructions Jump and CALL instructions, and Example programs in assembly language.	
	• **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY**	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	
3.	**List of Practicals:**	
	((Following practicals are to be performed using discrete components)	
	1. Verify truth table of variety of logic gates 2. Flip-flops using NAND/ NOR Gate. 3. Half-Adder/ Half-subtarctor Circuits 4. Full-Adder/ Full-subtarctor Circuits . 5. 4-Bit Gray To Binary/ Binary To Gray Code convertor using Select input. 6. RS and D flip flop using NAND gates 7. JK and T flip flops using NAND gates 8. Shift registers using D flip flops 9. 4-bit ripple counter 10. Implement mod 5 synchronous counter	
	(Following 8051 assembly programming PracticalS are to be performed Keil uVision tool)	
	11. Move block of Data from source to destination Keil uVision 12. Write assembly code to read data from array and compute sum 13. Develop assembly code to convert BCD to binary. 14. Write assembly code to convert Binary number to BCD	
4.	**Books Recommended:**	
	1. Mano Morris, “Digital Logic and Computer Design”, Pearson Education, 2019 Edition. 2. Anand Kumar, “Fundamentals of Digital Circuits”, PHI, 4th Ed., 2016. 3. Jain R. P. and Anand M. H. S., “Digital Electronics Practices using Integrated Circuits”, TMH, 1st Ed., 2004. 4. K. Ayala, “The 8051 Microcontroller”, Cengage Learning, 3rd Ed., 2009. 5. Muhammad A. Mazidi and Janice G. Mazidi, “The 8051 Microcontroller and Embedded Systems”, Pearson, 2nd Ed.,2013.	

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B.Tech.2 Semester IV COMMUNICATION AND SIGNAL PROCESSING EC3XX	Scheme	L	T	P	Credit
		3	0	2	04

1. Course Outcomes (COs):

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

CO1	Describe the basic knowledge of Communication techniques including analog and digital communication and details of wireless link
CO2	Explain about signal processing aspects involved in analog digital communication with time and frequency domain fundamentals.
CO3	Apply the concepts to the problems of communication techniques for optimizing the performance, may be using signal processing aspects.
CO4	Compare performance analysis of various modulation and coding techniques for a link, case study and problem solving as per given parameters.
CO5	Evaluate various stages of communication link and signal processing performance parameters by experimentation using modern tools/simulators and hardware.
CO6	Design the communication link with optimum parameter selection criteria satisfying given requirements.

2. Syllabus:

- **TRANSMISSION OF SIGNALS** **(08 Hours)**

Fourier Series, Fourier Transform Properties and their applications in communication systems, The Exponential Fourier Series, Aperiodic signal representation by Fourier Integral, Transmission of some useful functions, Signal Transmission Through a Linear System and Convolution concepts, Ideal versus Practical Filter, Channel as a filter

- **NOISE** **(03 Hours)**

Various Types of Noises: Internal (Shot, Thermal, Agitation, Transit Time) Noise and External (Atmospheric, Extra-Terrestrial, Industrial) Noise, White Noise and Filtered Noise, AWGN Properties

- **AMPLITUDE MODULATION AND DEMODULATION ECHNIQUES** **(06 Hours)**

Modulation, Antenna requirements, Transmission mediums, Baseband Vs Carrier Communications, DSB-C And DSB-SC Amplitude Modulation, Bandwidth Efficient AM: SSB, Vestigial Sideband (VSB) Transmission, Frequency Division Multiplexing.

- **FREQUENCY MODULATION AND DEMODULATION** **(04 Hours)**

Nonlinear Modulation, Bessel's function, Carson's Rule, Bandwidth of Angle Modulated Waves, NBFM and WBFM, Generating FM Waves, Demodulation of FM Signals.

- **SAMPLING AND PULSE MODULATION TECHNIQUES** **(08 Hours)**

Sampling theorem, Periodic Sampling, Frequency-Domain Representation of Sampling, Reconstruction of a Bandlimited Signals, Discrete-Time Processing of Continuous-Time Signals, Continuous the Sampling Processing of Discrete-Time Processing. Sampling and A to D conversion of signals, Quantization techniques—Uniform and Non-uniform, A-law and μ-law, Pulse Code Modulation, Pulse Amplitude Modulation, Pulse Position Modulation, Pulse Width modulation.

	● **DIGITAL DATA TRANSMISSION AND RECEPTION USING SIGNAL PROCESSING**	**(08 Hours)**
	Digital Communication System, Line Coding, Pulse Shaping For Optimum Transmission, ISI and ISI-Free transmission, Band-limiting of Rectangular Pulses, Raised Cosine Filtering, Regenerative Repeaters, Matched Filter And Equalizers, Eye Diagrams	
	● **BANDPASS SIGNAL TRANSMISSION-DIGITAL CARRIER SYSTEM**	**(08 Hours)**
	Representation Of Digital Modulated Signal, ASK, PSK, FSK, QAM (MODEMs) with Mathematics and Constellation Diagram, Spectral Characteristics of Digitally Modulated Signals. M-Ary Digital Carrier Modulation.	
	● **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY**	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	
3.	**List of Practicals:**	
	1. AM with Performance Analysis under Channel Effects. 2. FM with Performance Analysis under Channel Effects. 3. Sampling theorem 4. FDM and TDM 5. Simulation of ASK, FSK and PSK with study of constellation diagram. 6. Simulation of Line Coding Techniques. 7. Simulation and Implement the Effect of Raised Cosine Filter and pulse shaping. 8. Simulation of Eye Diagram,. 9. Source Coding Techniques 10. Error Control Coding Techniques.	
4.	**Books Recommended:**	
	1. Lathi B.P. and Ding Zhu, "Modern Digital And Analog Communication Systems", 4th Ed., Oxford University Press, 2010. 2. John G. Proakis and Masoud Salehi, “Digital Communications”, 5th Ed., McGraw-Hill, 2014. 3. Bhattacharya Amitabh, "Digital Communication", 1st Ed., Tata McGraw-Hill, 2006.	

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B.Tech.2 Semester IV SENSORS & INSTRUMENTATION EC4XX	Scheme	L	T	P	Credit
		3	0	2	04

1. Course Outcomes (COs):

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

CO1	Explain the different types of sensors, signal conditioning and data acquisition methods with working principle
CO2	Apply the concepts of sensors and instrumentation for various applications
CO3	Analyze different sensors and signal conditioning methods for various real time applications.
CO4	Evaluate the applications of sensors and data acquisition methods in instrumentation.
CO5	Design the sensors systems for different applications

2. Syllabus:

- **CONCEPTS AND TERMINOLOGY** **(04 Hours)**

Definition of Sensor, Transducer And Actuator, Transducer/Sensor Classification, Criteria to Choose a Sensor, Sensor Classification, Measurement Systems, General Input-Output Configuration, Static and Dynamic Characteristics of Sensors.

- **PASSIVE SENSORS** **(10 Hours)**

Potentiometers, Strain Gages, Resistive Temperature Detectors (RTDs), Thermistors, Light-Dependent Resistors (LDRs), Resistive Hygrometers, Resistive Gas Sensors, Capacitive Sensors, Inductive Sensors, Hall effect Sensors, Optical Sensors, Acoustic Sensors, SAW Sensors

- **SELF-GENERATING SENSORS** **(08 Hours)**

Principle of operation, construction, theory, advantages and disadvantages and applications of following transducers: Thermocouple, Piezo-electric transducer, Pyroelectric transducers, Photo-voltaic transducer, Electrochemical transducer.

- **SIGNAL CONDITIONING FOR SENSORS** **(09 Hours)**

Voltage Dividers, Wheatstone Bridge, Sensor bridge calibration and balance, Differential And Instrumentation Amplifiers, Interference, Specific Signal Conditioners for Sensors, Telemetry system.

- **DATA ACQUISITION METHODS** **(09 Hours)**

Basic block diagram, Analog and Digital IO, Timers, Type of ADC: Successive approximation and sigma-delta, Types of DAC: Weighted Resistor and R-2R Ladder type, Use of Data Sockets for Networked Communication.

- **ADVANCEMENTS IN SENSORS AND INSTRUMENTATION** **(05 Hours)**

Sensors For Robotics, Sensors Used In Smartphones, Sensors Used In Smart City, MEMS, Nano Sensors, Smart Sensors, Integrated Sensors, IoT Applications, Study of Sensor IC/Module datasheet.

- **PRACTICAL WILL BE BASED ON THE COVERAGE OF THE ABOVE TOPICS SEPARATELY** **(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)

3.	**List of Practicals:**
	1. To study the characteristics of the Potentiometer. 2. To study the characteristics of Variable Capacitor 3. To study the characteristics of Strain Gauge. 4. To study the characteristics of Light Dependent Resistor. 5. To study the characteristics of LVDT 6. To study the characteristics of the Resistance Temperature Detector 7. To study the characteristics of a Thermistor. 8. To study the characteristics of Thermocouples. 9. Design and Implement a Simple R to V, V to I, and V to V Convertor given specifications. 10. Bridge Linearity technique using Op-AMP. 11. Instrumentation amplifier using Feedback. 12. DATA acquisition using DAQ card.
4.	**Books Recommended:**
	1. Arun K. Ghosh, Introduction to Measurements and Instrumentation, PHI 4th Edition 2012. 2. Arun K. Ghosh, Introduction to Transducers, PHI, 2014. 3. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013. 4. S. Vijayachitra, Transducers Engineering, PHI 2016. 5. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.
5.	**Reference Books:**
	1. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition2013 2. Gary Johnson / Lab VIEW Graphical Programing II Edition /McGraw Hill 1997.