Details of Laboratories in ECE department

Sl no.	Location	Details of the Lab.	Year	About the Lab.
1.	SB-I / Ground floor	▪ Circuit Theory & Network Lab	▪ 2nd Year ECE	▪ **Major facilities available** ➢ Function Generators ➢ Measuring instruments such as digital multimeters, CRO, Ammeters, Voltmeters etc ➢ DC Power supplies ➢ Transistor Characteristics with Meters ➢ OP AMP Characteristics Kit ➢ OP AMP Application Kit ➢ Digital IC Trainer Gates ➢ MATLAB ➢ PSPICE ▪ **Objective** The major objective of this lab is to provide the students with the working knowledge of electrical circuits. This lab helps to verify various network theorems which are the base of simplification of any complicated circuit. It also helps to analyze the transient behaviour of a passive circuit which is very important from stability perspective. This lab gives the platform to understand the characteristics of a circuit under resonance and to determine different important parameters of a real two port network. It also introduces a simulating tool like PSPICE where circuits can be simulated and analyzed before implementing into real world to avoid damage to the physical circuit and also it makes the process faster and easier by reducing the human efforts. This lab also introduces robust software like MATLAB which is very useful in almost every field of engineering.

				▪ **Outcome** After completing this lab a student will be able to ➢ Handle various instruments like meters, CRO, function generator confidently. ➢ Make any complicated circuit on the board and simplify them based on various network theorems. ➢ Determine different important parameters of a two port network. ➢ Analyze the characteristics of a circuit under resonance and transient. ➢ Generate different signals in MATLAB which can be processed through a system later on. ➢ To explore different transform domains and their properties. ➢ To simulate a circuit in PSPICE almost under any condition, that is possible for real hardware.
2.		▪ Basic Electronics lab.	▪ 1st Year ECE & CSE	▪ **Major facilities available** 1. In this laboratory there are sufficient number of working benches (nearly 20), so that the students can work comfortably. Each of the benches is fully equipped with: a) Function Generators b) Power supplies c) Measuring instruments like digital multimeters, C.R.O, Ammeters, Voltmeters etc. d) Testing Instrument MFG.CO.PVT.LTD(MECO-V) e) Transistor Characteristics with Meters(Futuretech) f) OP AMP Characteristics Kit(Futuretech) g) OP AMP Application Kit(Futuretech) h) Digital IC Trainer Gates(Futuretech) 2. Before starting of the laboratory the students are instructed with necessary

				safety and precautionary measures those are to be adopted in any electrical laboratory. 3. Well designed laboratory manual / instruction sheets are provided to students at the beginning of the session for a particular lab. 4. Laboratory is maintained and conducted by well trained technical supporting staff under the supervision of the faculty members. 5. Due to availability of many instruments, we can make groups each consisting of two students for an experiment. 6. There are two working benches, which are set apart for assembly of circuits, with facilities of soldering and desoldering electronic tool kits, etc. 7. Training in this laboratory is done through properly planned structured programme with the following sequences: i) Introduction and identification of different active and passive electronic devices / components. ii) Familiarization with different signal sources and instruments used in electronic engineering. In the process, the students can learn the significances of the manufactures specifications etc. iii) To learn the use/ handling of different measuring instruments like multimeters, C.R.O etc. ▪ **Objective** This is a first level laboratory in which students are introduced with the practical aspects of Electronics & Communication Engineering for the first time, and are trained with preliminaries of Electronics, with the following in mind • To impart the students practical engineering skills by way of breadboard circuit design with electronic devices and components. • To help design and analyze various Electronic circuits such as BJT, JFET, applications of operational amplifiers, digital circuits etc. so that students are able to understand the practical aspects of basic electronics theory. • To provide a platform for undergraduate and graduate students for practical implementation of Electronics Circuits and Projects. • To bring Engineering students to level of industrial standards in field of electronic circuits and projects.

				• To provide students with an environment for simulation of projects and check their feasibility. • To provide the platform for the integration of academics and research. ▪ **Outcome** • Improved ability to apply knowledge of mathematics, science, and engineering. • Improved ability to design circuits and electronic instruments and conduct experiments as well as to analyze and interpret data. • Improved ability to use mathematical models to replicate the behaviour of an actual electronic device or circuit by performing experiments, leading to electronic circuit simulation • Allow the students to be Industry ready, enhancing employability
3.		▪ Solid State Devices Lab.	▪ 2nd Year ECE	▪ **Major facilities available:** 1. In this laboratory there are sufficient number of working benches (more than 10), so that the students can work comfortably. Each of the benches are fully equipped with: a) Function Generator b) Power supply c) Measuring instruments like digital multimeter, A.C milli voltmeter, C.R.O etc. 2. There is a working bench, set aside for assembly of circuits, with facilities of soldering and desoldering, electronic tool kits etc. Major Equipments in the Lab Power Supply, CRO, AC Millivolt meter, Function generator. 3. Support Software: Pspice student version ▪ **Objective:** This lab is newly introduced in the curriculum of WBUT for the B.Tech students of ECE 2nd year 3rd semester. The purpose of this lab is to realize the characteristics of various semiconductor devices such as BJT, JFET, and RC coupled amplifiers etc. using breadboard and also using suitable software. This lab gives the proper justification of theoretical knowledge in practical domain by the help of numerous components and equipment present in the laboratory. ▪ **Outcome:**

				An ability to verify the working of different diodes, transistors, CRO probes and measuring instruments. Identifying the procedure of doing the experiment. An ability to design the circuits with basic semiconductor devices (active & passive elements), measuring instruments & power supplies that serves many practical purposes. To reinforce learning in the accompanying course through hands-on experience with electronic device analysis, design, construction, and testing. To provide the student with the capability to use MATLAB and PSpice software as tools in electronic device circuit analysis and design, and in future courses, design projects, and professional work assignments. Knowledge of Engineering core: This course adds electronic device analysis and design applications to fundamental concepts of devices. ▪ Use of contemporary tools for analysis and design: This course applies computer methods using Pspice, MATLAB software tools to electronic device analysis.
4.		▪ Signal System Lab.	▪ 2nd Year ECE	▪ **Major facilities available** 1. MATLAB 2. Trainer kit for sampling a signal 3. XILINX Integrated Synthesis Environment for synthesis and analysis of HDL designs • ISE foundation 4. Xilinx FPGA products • Spartan 3AN Starter kit • Vertex 5ML 501 evaluation and development board ▪ **Objective** The main objective of this lab is to introduce the concept of generation of different types of signals (both continuous time and discrete time) and the analysis of their mathematical properties with the help of different mathematical transforms like Fourier, Laplace and Z-transform. This lab is useful for practical learning and understanding of sampling process both from the hardware and software point of view. The concept of convolution and filtering also can be developed here where the design of filters can be implemented in MATLAB using filter design tool and also by using active and passive components in

				breadboard, ▪ **Outcome** After completion of this course a student will be able to generate a variety of signals and will be able to extract information from the signals by changing their domains. They will have the understanding of the internal structure of the signals by doing mathematical analysis of the signals. By having the theoretical concept of sampling, its practical verification and the practical study of the aliasing effect will be done by them. They will be able to design and implement different types of filter (both FIR and IIR) and their responses also can be studied and analysed by them. Most importantly using Hardware Description language they will be able to design digital circuits and the performance of the circuits can be validated using FPGA kit.
5.		▪ EM Theory & Transmission Line Lab.	▪ 2nd Year ECE	▪ **Major facilities available** AM/FM Function-pulse Generator Motorized Antenna Trainer with transmitter unit, detector unit and different antennas. Microwave test bench with Gunn power supply, VSWR meter etc, Microwave test bench with horn antenna. Spectrum Analyser Plenty of computers are available, all are installed with MATLAB. ▪ **Objective** Electromagnetic Theory covers the basic principles of electromagnetism. The principle objective of this lab is to introduce the concept and behaviour of different types of antennas like dipole, folded dipole, pyramidal horn and Yagi-Uda antenna etc. It will help to develop the understanding of the load impedance, the input impedance and the characteristic impedance of the transmission line, the propagation of signals through the transmission line and the response of the transmission line. The introduction to polar graph and Smith-chart is also given here. ▪ **Outcome** After completion of this course, a student will be able to study the radiation pattern of different antennas using polar graph and calculate the parameters of the antennas like Half power beam width(HPBW), First null beam width(FNBW), directivity and gain. They will be able to plot the standing wave

				along a transmission line when the line is open circuited, short circuited and terminated by a resistive load at the load end. Using shift in minima method they will determine the input impedance of a terminated co-axial line. Using spectrum analyser the frequency domain information of different signals can be extracted by the students. Students will create Smith chart by doing MATLAB coding and the different parameters like the input impedance, the reflection coefficient and the voltage standing wave ratio (VSWR) of a transmission line can be calculated using Smith chart.
6.	SB-I / 1st floor	▪ VLSI Design Lab.	▪ 4th Year ECE	▪ **Major facilities available:** 3. Mentor Graphics IC Nanometer Design Bundle Tools (HEP-1) **2.** XILINX Integrated Synthesis Environment for synthesis and analysis of HDL designs • ISE foundation • Chip scope pro **3.** Xilinx FPGA products • Spartan 3AN Starter kit • Virtex 5ML 501 evaluation and development board ▪ **Objective** The major objective of this lab is to introduce the technology, design concepts, electrical properties and modelling of Very Large Scale Integrated circuits. This lab introduces the practical learning of CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects. It also introduces an understanding of the characteristics of CMOS circuit construction using Hardware Description Language (HDL). It will help to complete a significant VLSI design having a set of objective criteria and design constraints. It will provide knowledge in designing integrated circuits using Computer Aided Design (CAD) Tools. ▪ **Outcome** A student completing this laboratory course should, at a minimum, be able to: Use ASIC design methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their

				interconnect. Create models of nanometer sized CMOS circuits that realize specified digital functions. Apply CMOS technology-specific layout rules in the placement and routing of transistors and interconnect, and to verify the functionality, timing, power, and parasitic effects. Understand the characteristics of CMOS circuit construction and the comparison between different state-of-the-art CMOS technologies and processes. Complete a significant VLSI system design having a set of objective criteria and design constraints using Hardware Description Language (VHDL) and validating the system in FPGA
7.		▪ Object Oriented Programming Lab.	▪ 3rd Year ECE	▪ **Major facilities available:** Total thirty four number of computer with high configuration. Latest version of IDEs like Eclipse , NetBeans and IntelliJ etc are installed in computers ▪ **Objective:** Students learn object oriented programming using JAVA from very basics to the advance level to make them expertise for meeting the requirements of IT industries. Students also develop stand-alone as well as web browsing based softwares under the guidance of experts having industry experience to make themselves ready for job. ▪ **Outcome:** At the end of the laboratory students will be able to: Write any back-end program for any software. Handle any string related issue, exception etc. Write multi-thread program Develop calculator using Applet as well as swing. Develop any other stand-alone as well as web based software using Applet and Swing.
8.		▪ Robotics Lab.	▪ 4th Year ECE	▪ **Major facilities available:** Students get the opportunity to build their own autonomous mobile robots by integrating individual components. Reprogram the autonomous robot to assign different tasks

				RoboAnlyzer Simulator for analyzing robot kinematics and dynamics ▪ **Objective:** The main objectives of this laboratory are to familiarize with components of autonomous robotic systems and their role, build autonomous mobile robots by integrating individual components and provide ideas of practical approaches for navigating robots. ▪ **Outcome:** At the end of the laboratory students will be able to: ➢ understand the importance of robot dynamics ➢ analysis kinematics of robot manipulators ➢ understand the functionality and limitations of robot actuators and sensors ➢ solve problems related to robot control and navigation ➢ program an autonomous robot to perform various tasks like following a given path, reach to a goal by avoiding obstacles on the way, to pick up an object and place it in a given position etc. ➢ solve various robotics problem in RoboAnalyzer (simulator).
9.		▪ Numerical Lab.	▪ 2nd Year ECE	▪ **Major facilities available** Plenty of computers are available and all are installed with Turbo C and MATLAB. ▪ **Objective** Problems of the real world have measurement errors. In this lab we introduce different methods (algorithms) that are used to give approximate number solutions to situations where it is unlikely to find the real solution quickly, and teach them to improve upon these methods so as to reduce the amount of error generated by computer calculation. For any area of work requiring precise calculations, study of numerical analysis is very much essential. The concept of different algorithms for • Computing integrals and derivatives • Solving differential equations • Building models based on data, be it through interpolation, Least Square, or other methods • Root finding and numerical optimization • Estimating the solution to a set of linear equation, algebraic equation and

				differential equation. • Computational geometry A brief introduction to the open source software Scilab and system engineering software Labview for applications which require testing, measurement etc is given in this lab course. ▪ **Outcome** A student by completing this laboratory course will be able to: Calculate the value of a function f(x) at any value of x with the help of Lagrange's interpolation method and Newton's interpolation method. Find the solution of a system of liner equation by Gauss elimination method, Gauss –Siedel iteration method. Find the solution of algebraic equation using Newton-Raphson method and Regula Falsi method. Find the solution of differential equation using Euler's method and Rung-Kutta method. Calculate numerical integration using Weddle's method, Trapezoidal rule and Simpson's 1/3 rule Students will also be able to do coding for computation in Scilab and MATLAB. They will acquire enough knowledge to handle the software Labview.
10.		▪ Data structure & C Lab**.**	▪ 3rd Year ECE	▪ **Major facilities available** Plenty of computers are available and all are installed with Turbo C and Dev C. ▪ **Objective** Data Structures are used all the time in general software probably more than anything else. If a student is working with an object oriented programming language or with some procedural language he/she will need arrays and/or lists. The concept of array which stores multiple data of single type in a continuous way and structure which stores heterogeneous data are introduced here. The introduction to queue, stacks and linked list and different operations on them to manipulate data is given in this lab course. The idea of storing , manipulating and arranging data using different sorting and searching algorithms can be developed in this lab. The concept of tree and the application of various trees in practical life is given here.

				▪ **Outcome** After completing this lab course a student will be able to store, manipulate and arrange data in an efficient manner by implementing the algorithms by doing coding. They can insert data at any position or can delete data from any position or search for a particular element in a linked list, they can reverse the linked list or traverse through it. Addition of two polynomials with the help of array and linked list both, similarly addition and multiplication of two sparse matrices can be done by them. They will be able to implement queue and stack using arrays and linked list. Implementation of circular queue ,binary tree and binary search tree and the traversing through the binary tree are the other things to be done by them. A large volume of data can be sorted by the students and a particular element can be searched in the data set. They can also be able to do a comparative study of different algorithms for sorting (like bubble sort, insertion sort, merge sort, quick sort, selection sort) and searching (linear search, binary search, and hash table) based on time complexity.
11.	SB-I / 2nd floor	▪ Analog Communication Lab.	▪ 3rd Year ECE	▪ **Major facilities available** CRO DSB-SSB transmitter trainer kit(ST-2201) DSB-SSB receiver trainer kit(ST-2202) Frequency modulation and demodulation trainer kit(ST-2203) Distortion meter(ST-4092) Spectrum analyzer Bread board trainer kit digital multimeter ▪ **Objective** This course provides a thorough introduction to the basic principles and techniques used in electronic communications systems. The course will introduce a different types of analog modulation techniques like AM ,FM and variety of their parameter such as finding of modulation index, signal to noise ratio of amplitude and frequency modulated wave,distortion of amplitude modulated wave, how much power can be utilised and wastage in DSB, DSB-SC and SSB-SC, generation and detection of modulated wave using discrete components ,communication transmitter and receiver kit,frequency modulation using VCO, analysis of frequency spectrum and bandwidth using spectrum analyzer, find out lock range and capture range using PLL IC, analysis of

				selectivity, sensitivity and fidelity of super heterodyne radio receiver. The course also introduces analytical techniques to evaluate the performance of communication systems. ▪ **Outcome** A student completing this laboratory course should, at a minimum, be able to: ➢ Understand amplitude modulation technique and how different modulation index can be measured, ➢ understand the power calculation of DSB, DSB-SC and SSB-SC wave and difference between them. ➢ Also get little bit idea of signal to noise ratio i.e SNR and distortion of AM wave.understand the difference between noise and distortion. ➢ Get some idea of frequency modulated wave, power of NBFM and WBFM and also band width of NBFM and WBFM. ➢ also understand theselectivity, sensitivity and fidelity of super heterodyne radio ➢ receiver.
12.		▪ Digital Communication Lab.	▪ 3rd Year ECE	▪ **Major facilities available** Data formatting and carrier modulation transmitter trainer kit Data reformatting and carrier demodulation receiver trainer kit TDM-PCM transmitter trainer kit TDM-PCM receiver trainer kit Binary data generator DM/ADM/delta-sigma modulation & demodulation trainer kit ▪ **Objective** This course provides a thorough introduction to the basic principles and techniques used in digital communications. The course will introduce digital modulation techniques such as PAM, PCM, DM and ADM,different line coding techniques such as unipolar, bipolar, polar, RZ, NRZ, Manchester and biphase mark(1),analysis ofdifferent baseband modulation techniques such as ASK modulation and demodulation, FSK modulation and demodulation, and PSK modulation and demodulation, also generate the 7bit and 15 bit PN sequence using PN sequence genereter,analysis the BPSK modulation and demodulation technique in SIMULINK and also plot BER of BPSK.analysis the QPSK modulation and demodulation technique in SIMULINK and also plot BER of

				QPSK. ▪ **Outcome** A student completing this laboratory course should, at a minimum, be able to: ➢ Understand how an analog signal can be converted to a digital signal by using three steps such as sampling, quantizing and encoding. ➢ Generate the PAM and demodulation and PCM and demodulation by using the sampling theorem. ➢ understand DM and what types of error can be produced and how these can be overcome by using ADM technique. ➢ Generate the different baseband modulation technique such as ASK, FSK and PSK. ➢ Design the BPSK modulator and demodulator in SIMULINK and also plot BER of BPSK. ➢ Design the QPSK modulator and demodulator in SIMULINK and also plot BER of QPSK.
13.		▪ Optical Communication & N/W Lab.	▪ 4th Year ECE	▪ **Major facilities available:** Optical Fiber Trainer Kit(ST-2501) Optical Fiber Trainer Kit(ST-2502) Digital Fiber Optical Link(ST-2507) Laser Optical Trainer Kit(ST-2506) Optical Power Meters(ST-2551) Cathode Ray Oscilloscopes(Caddo 803) Multimetesr, Optical fibers etc. ▪ **Objective:** Optical fibres now constitute the backbone of the world's long-distance telecommunications systems and are also being used increasingly in other areas, such as sensing, biophotonics, automotive, etc. The course sets out to provide a basic understanding of optical transmission systems concentrating on light propagation along fibres and light processing using fibre- and planar waveguide-based devises. Light propagation includes: modal propagation and Maxwell's equations; ray tracing, Snell's and Fesnel's Laws; single-mode, multi-mode and special fibres; pulse propagation and dispersions; nonlinear effects; fibre and planar waveguide fabrication; analytical and numerical techniques; birefringence and bend

				loss. Laboratory work covers mainly hands-on fibre-based experiments and some numerical simulations. ▪ **Outcome** A student completing this laboratory course should, at a minimum, be able to: Measure the basic properties of the propagation of light in a guided-wave dielectric optical fiber, including attenuation, coupling, NA and handling Understand the difference between single mode and multimode fiber and where the two are appropriate in a real-world system Understand waveguiding principles, the concept of a mode in fiber, and how this limits the bandwidth in such systems, and to be able to make measurements that directly and indirectly determines these parameters Understand how a pulse (or a bit) propagates in optical fiber and is influenced by dispersion Understand the differences between types of light sources utilized in lightwave systems, including bandwidth, power, modulation, and spectra, and the appropriateness of each in a given system configuration Understand the differences between types of receivers utilized in lightwave systems, and the appropriateness of each in a given system configuration, including bandwidth, signal-to-noise, and the statistical nature of light-matter interactions Be able to quickly assemble a fiber optic link, including source, receiver, and propagation medium and understand its main performance limitations
14.	SB-I / 3rd floor	▪ Digital Electronics & Integrated Circuits Lab**.**	▪ 2nd Year ECE	▪ **Major facilities available:** Sufficient number working benches (more than 8) are there in this laboratory for the easiness of students work. Each of the benches is fully equipped with: i) Power supply ii) Function Generator iii) C.R.O etc. *Major Equipment in the Lab* Fixed and variable Various power supplies Multiple power supply Digital multimeters Function generators Cathode ray oscilloscope IC Tester: Digital IC Tester

				Analog IC Tester ▪ **Objective:** Digital Electronics is technology subject which is intended to make students familiar with different types of designs as sequential logic circuits, combinational logic circuits, trouble shooting of various digital systems & study of various digital systems. Knowledge of basic electronics & digital techniques is useful in understanding theory and practicals of the subjects. For years, applications of digital electronics were confined to computer systems. Today digital electronics are applied in many diverse areas such as telephony, data processing, radar, navigation, military systems, medical instruments, process controls etc. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits. To prepare students to perform the analysis and design of various digital electronic circuits. ▪ **Outcome:** Have a thorough understanding of the fundamental concepts and techniques used in digital electronics. To understand and examine the structure of various number systems and its application in digital design. The ability to understand, analyze and design various combinational and sequential circuits. Ability to identify basic requirements for a design application and propose a cost effective solution. The ability to identify and prevent various hazards and timing problems in a digital design. To develop skill to build, and troubleshoot digital circuits.
15.		▪ Microprocessors & Microcontrollers Lab.	▪ 3rd Year ECE	▪ **Major facilities available** Microprocessor Trainer Kit ADC Kit 8251 Study Card Latch Buffer Card Stepper Motor Card, SMC Kit MMD Kit

				Latch Buffer Microcontroller Trainer kit DC Motor Interface, DC Motor module EPROM Eraser Cathode Ray Oscilloscopes 8255 PPI on Trainer kit Seven Segment Display, Key Board ESA 85 Driver, ESA 51 Driver, Micro3(8085 Simulator) USB to USART Connector ▪ **Objective** Microprocessor technology is an exciting, challenging and growing field which will pervade industry for decades to come. Ever since, the invent of first microprocessor to the latest, microprocessors have been used in different applications. To meet the challenges of this growing technology, one has also to be conversant with the programming aspects of the microprocessor and microcontroller. This practical course of microprocessor and microcontrollers presents an integrated approach to hardware and software in the context of 8085 microprocessor and 8051 microcontroller. The main objective of this lab course is to gain the practical hands on experience of programming the 8085 microprocessor and 8051 microcontroller and also to gain knowledge on interfacing of different peripherals to microprocessor. ▪ **Outcome** A student completing this laboratory course should, at a minimum, be able to: ➢ Write Assembly language program to perform some basic operations like i. data transfer, Load/Store, Arithmetic, Logical operations ii. different code conversions iii. copying and shifting block of memory iv. String Matching, Multiplication using shift and add method and Booth's Algorithm using 8085 processor and 8051 microcontroller on both trainer kit and simulator on PC ➢ Interface 8255 peripheral chip and I/O devices with the same processor and controller for reading switch state, glowing LEDs

				➢ Interface Keyboard and Multi-digit Display with multiplexing using 8255 ➢ Write programs to interface of Keyboard, DAC and ADC using 8051 micro controller kit. ➢ Study timing diagram of an instruction on oscilloscope. ➢ Perform Serial communication between two trainer kits Design systems based on above mentioned processors and controller by means of efficient assembly language programming
16.		▪ Analog Electronic Circuits Lab.	▪ 2nd Year ECE	▪ **Major facilities available** In this laboratory, there are sufficient number of working benches, so that the students can work comfortably. Each of the benches are fully equipped with: a) Function generator b) Power supply c)Measuring instruments like digital multimeter, Cathode Ray oscilloscope etc. 1) Function generator- (Scientech, Gwinstek). 2) Variable Power supply: fixed and variable variety with different current rating. Make – Elnova, Scientech etc. 3) Digital multimeter (Gwinstek, CIE, Metravi) 4) Cathode Ray Oscilloscope. (25MHz, 30 MHz, Gwinstek) 5) Trainer Kit. a) Transistor Push Pull Amplifier. (Scientech) b) Digital to analog Converter (Scientech) c) Analog to Digital Converter. (Scientech) d) V.C.O & PLL. (Scientech) e) Class A Amplifier. (Scientech) f) Class B Amplifier. (Scientech) g) Class C Tuned Amplifier. (Scientech) ▪ **Objective** The laboratory introduces students to practical, circuit design and contributes significantly to provide them with engineering skills. The experiments covered in this laboratory are synchronized with its theoretical part, so that students might be able to understand the practical aspects of it. Students can build simple circuits by understanding electronics schematics and set working prototype

				circuits. The purpose is to teach analog circuit design theory and to give the student an understanding of the factors governing the behaviour of electronic circuits. Topics covered also demonstrate the need for strong electronic component in other scientific and engineering fields. The students are encouraged to analyse the requirements and determine the fundamental criteria of sound circuit design the main intention of this laboratory is to give introduction to different steps used in the design of electronic systems according to industrial standards. ▪ **Outcome** The laboratory sessions provide learning opportunities that should enable the student to do the following upon completion of this course: Acquire a basic knowledge in electronics including diodes, BJT, and operational amplifier. Develop the ability to analyse and design analog electronic circuits using discrete components. Observe the amplitude and frequency responses of common amplification circuits. Design, construct, and take measurement of various analog circuits to compare experimental results in the laboratory with theoretical analysis. Explore the operation and advantages of operational amplifiers. Learn to design different types of filters and apply the same to oscillators and amplifiers. ▪ Exploring the circuitry which converts an analog signal to digital signal.
17.		▪ Electronic Measurement & Instrumentation Lab.	▪ 3rd Year ECE	▪ **Major facilities available** Trainer kit for static characteristics, Trainer kit for dynamic characteristics, Trainer kit for DMM Trainer kit for DAS Bread board trainer kit CRO ▪ **Objective** This course provides a thorough introduction to the basic principles and techniques used in electronic measurement and instrumentation lab. The course will introduce different measurement techniques such as static characteristics such as accuracy, precision and hysteresis of the measuring

				instruments, dynamic characteristics such as critical damping, under damping and over damping of the measuring instruments, find out lock range and capture range using PLL IC, design the circuit of current to voltage converter and voltage to current converter using IC 741. unknown DC voltage, voltage drop across the resistor and voltage drop across the diode can be measured by the DMM trainer kit. and also measure the statistical analysis of error of a measuring instruments. ▪ **Outcome** A student completing this laboratory course should,at a minimum be able to: Measure the accuracy, precision, error and hysteresis of a measuring instruments and also differentiate between accuracy and precision, understood thedynamic characteristics such as critical damping, under damping and over damping of the measuring instruments.
18.		▪ Electronics Design Lab.	▪ 4th Year ECE	▪ **Major facilities available** 1. GSP-810 2GHz GW instek 2GHz spectrum analyser 2. GOS-630FC,GW instekanalog oscilloscope 3. GDS-3000 SeriesGW instekdigital storage oscilloscope with 500MHz ,4 Channelsand 100GSa/s ET Sampling Rate 4. SFG-1013 GW instek DDS signal generator. 5. GPR-H Series DC power supply 6. Trainer board facilitate with CK generator , led driver display and regulated power supply 7. CIE 122, Mastech, Gwinstek digital multi meter 8. LCR meter, capacitive banks, etc ▪ **Objective** The laboratory serve the students to discover their essential knowledge of electronic circuit design and fault analysis in the field of communication systems engineering, measurement instrumentation, analog and digital electronics based circuit .This laboratory enhance hands on experience of the students to design different electronics circuits with the help of bread boards ,different active & passive components and high ends test and measuring instruments.

				▪ **Outcome** • Gain practical electronics laboratory experience • Understand and analyze fundamental transistor circuit topologies • Understand and analyze DC bias and small signal gains for Bipolar Junction Transistor (BJT) Amplifiers • Understand and analyze the line regulation and load regulation characteristics of variable regulated power supply • Understand and analyze frequency response of multistage BJT and MOSFET amplifiers with varying gain • Understand and analyze transistor based CMOS digital electronics building blocks •Able to design different types of sequential logic circuits broadlyused in communication enggand consumer electronics
19.		▪ Advanced Embedded System Lab	▪ R & D	▪ **Major facilities available** • Instruments: Digital Storage Oscilloscope(DSO), High BW-high resolution-Spectrum Analyzer, Frequency Synthesizer, Logic Analyzer • Software Tools: MATLAB from MathWorks Inc, code-composer-studio from Texas Instruments, CCS C compiler and MPLAB IDE for PIC uCs from Microchip Inc. • Hardware Tools/kits : C6713 DSP kits from TI, PIC uC kits from Microchip, ARM7TDMI kits, ARM-Cortex uC kits from NXP, pSOC kits from Cypress. ▪ **Objective** • To develop and nurture expertise in the field of Embedded Systems Design. • To facilitate, practice, conduct and contribute to the research with the application of embedded systems for the well being of society. • To impart a solid, high quality workable knowledge of Embedded Systems to the students. ▪ **Outcome** • Working prototypes of embedded systems for real time applications. • Given the requirement/specification, one will be able to Design and Implement the system for the real time apllication.

				• High quality research papers contributing to the ongoing research for the improvement of overall living quality. High quality student projects
20.		▪ Advanced IC Design Lab	▪ R & D	▪ **Major facilities available** Established in 2010, this laboratory has been advancing through research in fields of digital IC design and providing knowledge by delivering information to the students. The major tools are listed below: ***EDA tools for VLSI design :*** **1. Cadence (2010-2014):** Cadence VLSI tool consisting of Analog/Digital front-end and backend andHigh speed PCB Design tool. • Virtuoso(R) Analog Design Environment • Virtuoso(R) Schematic VHDL Interface • Virtuoso(R) Schematic Editor Verilog(R) Interface • Assura(TM) Layout Vs. Schematic Verifier • Allegro PCB Design XL. • Spectre Circuit Simulator **2. Mentor Graphics IC Nanometer Design Bundle Tools (HEP-1) (2014-present)** The tool provides a complete environment for the VLSI design, capture, layout and verification of analog, digital and mixed-signal integrated circuits. The tool includes, **The Pyxis suite of IC design tools** • Schematic capture, netlisting, simulation set-up and results viewing. • Physical layout • Editing, schematic-driven layout, and top-level floor planning and routing. **Questa ADMS and Questa AMDS RF** - A language-neutral, mixed-signal simulator that enables top-down design and bottom-up verification of multi-million gate analog/mixed-signal SoC designs. **Eldo and Eldo RF** - An analog simulator offering numerous simulation and modelling options that deliver high-performance and high-speed simulation with the accuracy required by the user. **ADiT™** - A fast-SPICE simulator built specifically for analog and mixed signal applications.

				Calibre - The industry standard platform for physical verificationand design for manufacturability of deep sub micron integrated circuits, offering superior performance and capacity for both flat and hierarchical algorithms. **Calibre xRC**- Accurate transistor-level, gate-level and hierarchical parasitic extraction. ▪ **Objective** The electronics industry has achieved a phenomenal growth over the last few decades, mainly due to the rapid advances in integration technologies and large-scale systems design. Typically, the required computational and information processing power of these applications is the driving force for the fast development of this field. The objective of this lab. is to help students/researchers develop in-depth analytical and design capabilities in digital CMOS circuits and chips. The development of VLSI chips requires an interdisciplinary team of architects, logic designers, circuit and layout designers, packaging engineers, test engineers, and process device engineers. Also essential are the computer aids for design automation and optimization. Thus, the ability to understand, analyze and design such systems has become an indispensable skill that modern VLSI researcher must have. The lab. seeks to provide the students/researchers with strong hardware design fundamentals suitable for either higher studies or for employment with computer-design companies. It will serve to provide the groundwork that the students/ researchers require in the digital IC design area. The laboratory facilities will give the students/researchers genuine design experience, introducing them to the use of CAD tools for circuit design and full custom layout. The research projects carried out in this laboratory is focused on a wide area of research in the fields of VLSI. ▪ **Outcome** Some significant design projects have been published in various journals and conferences. A brief account is given below: • Low power combinational circuit design using Cyclic Combinational Gate Diffusion Input Technique • Low power High Speed CMOS OP-AMP design

				• High Speed ALU design using full swing TG • Low power high speed ring modulator based VCO design • Design & study of low power high speed full adder circuits. • Sequential & combinational circuit design using ternary logic • Reconfigurable modulator based on Ternary Logic • Configurable modulator design using ternary logic • Design & study of low power high speed Look ahead Carry generator • GDI dual edge triggered DFF design • Low power Vedic multiplier design using GDI • A true “Lab-on-a-chip” • Processor with reconfigurable DSP system • Low power Level shifter design