GUJARAT TECHNOLOGICAL UNIVERSITY

BASIC ELECTRONICS (Modified Version January 2014)
SUBJECT CODE: 2110016
B.E. 1st YEAR

Type of course: Basic

Prerequisite: N.A.

Rationale: N.A.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE Viva (V)	PA (I)	
4	0	2	6	70	30*	30#	20**	150

L- Lectures; T- Tutorial/Teacher Guided Student Activity; P- Practical; C- Credit; ESE- End Semester Examination; PA- Progressive Assessment

Content:

Sr. No.	Topic	Teaching Hrs.
1	Circuit Concepts • Electrical Quantities • Lumped Circuit Elements • Kirchhoff's Laws • Meters and Measurements • Analogy between Electrical and other Non-Electrical Physical Systems • A case study	6
2	Circuit Analysis Techniques: • Thevenin and Norton Equivalent Circuits • Node-Voltage and Mesh-Current Analysis • Superposition and Linearity • Wye-Delta Transformation • Computer Aided Circuit Analysis • A Case Study	8
3	Analog Building Blocks and Operational Amplifiers Basic ideas • The Amplifier Block • Ideal Operational Amplifier • Practical Properties of Operational Amplifiers • Applications of Operational Amplifiers • A case study	8
4	Digital Building Blocks • Digital System Building Blocks	8

	• Digital System Components • Computer Systems • Computer Networks • A case study	
5	Signal Processing: • Signals and Spectral Analysis • Modulation, Sampling and Multiplexing • Interference and Noise • A case Study	8
6	Communication Systems • Waves, Transmission Lines, waveguides and Antenna Fundamentals • Analog Communication Systems • Digital Communication Systems • A Case Study	6
7	Basic Control Systems • Feedback Control Systems • Digital Control Systems • A Case Study	6

Reference Books:

1. Introduction to Electrical Engineering, M S Sarma, Oxford University Press

Course Outcome:

After completion of the course, the student will be able to –

- Determine the behavior of simple passive electrical circuits with independent voltage and current sources.
- Design simple analog signal processing functions using operational amplifiers.
- Design simple combinational and sequential functions using gates and flip-flops.
- Explain the functioning of digital system components including DACs, ADCs, memory and display devices,
- Explain the organization of computer systems and computer networks.
- Determine the properties of simple signal processing systems.
- Determine the behavior of analog and digital communication systems.
- Determine the behavior of simple linear feedback control systems

List of Experiments:

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills so that students are able to acquire the competency. Following is the list of

experiments for guidance. A student should perform at least 10 experiments out of the given 14 with at least one experiment from each Unit

S. No.	Unit No.	Practical/Exercise	Apprx. Hrs. Required
1	I	a. Observe the behavior of RLC circuits with ideal and non-ideal voltage sources and current sources. b. Verify Thevenin's and Norton's Theorems	2
2	II	Simulate passive electrical circuits using Multisim simulator and compare the simulated response with that of the actual circuit	2
3	III	Determine the parameters of three commercial Op Amps	2
4	III	Perform simple analog signal processing functions using Op Amps	2
5	IV	Design simple combinational functions as per specifications and verify the correctness of your design	2
6	IV	Design simple sequential functions as per specifications and verify the correctness of your design	2
7	IV	Measure the characteristics of given DACs and ADCs	2
8	V	Simulate simple modulation, sampling, multiplexing, demodulation signal processing functions Multisim	2
9	V	Simulate simple filtering signal processing function Multisim	2
10	V	Measure the performance of a given signal processing system	2
11	VI	Determine the behavior of a given analog communication system through simulation using Multisim	2
12	VI	Determine the behavior of a given digital communication system through simulation using Multisim	2
13	VII	Determine the behavior of a second and third order control systems through simulation using Multisim	2
14	VII	Determine the behavior of a practical control system using ON-OFF and P controllers through simulation using SciLab Determine the behavior of a practical control system using PI and PID controllers through simulation using SciLab	2

Open Ended Problems:

1. Most of the electronic system and instruments operates with DC power. The student can be given a project a design a miniature regulated dc power supply, battery eliminator or charger for electronic devices, circuits and systems. The project can be given with modification to display the voltage and current on seven segments LED or LCD. There can be several designs for such projects. The project can be extended for multiple voltages those may be

needed for various applications such as for op-amp based circuits. Different student group may be provided with different voltage and current specifications for the dc power supply.

Note: This project can be divided into several parts.

2. The electronic counter can be interesting circuit to design. The students may be asked to design counter to count occurrence of events or objects. They may be asked to design from 2 to 4 digits. The project may need understanding of sensor and transducer as well as signal conditioning circuits. The project may extend to design digital clock.

3. The design of fastest finger first circuit. This project may be given for several inputs. It can be learning with fun. The students will learn about different switches and their operations. The interfacing with digital and analog circuits.

4. The design of oscillator circuits electronic oscillators are important circuits to be used for various applications. Students can explore analog and digital integrated circuits for design of oscillators of different frequencies and amplitude. This may extended for design of signal generators.

5. The design of water level indicator and controller may be given to students. In this case student can learn various types of level sensing mechanism and simple on-off control scheme implemented using analog electronic or digital electronic circuits.

6. Design a simple electronic circuit whose output voltage varies with temperature and light.

Major Equipment's:

(1) CRO (At least 20MHz)

(2) Function Generator (Frequency range up to 20 MHz) – need to have sine, square wave output.

(3) Dual Power Supply (0-12V/15V DC)/3A

(4) Micrometers for measurement of voltage and current with suitable ranges.

(5) Multimeter

(6) Various Electronics Components including different types of Op Amps and digital ICs.

(7) PCs

List of Open Source Software/learning website:

Software: Multisim and SciLab *(*www.scilab.org*)*
Learning Material: http://nptel.iitm.ac.in/. www.spoken-tutotial.org

*PA (M): 10 marks for Active Learning Assignments, 20 marks for other methods of PA;

ACTIVE LEARNING ASSIGNMENTS: Students will prepare power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus of Basic Electronics is covered. The power-point slides should be put up on the web-site of the

College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should be sent to achievements@gtu.edu.in.

**PA (I): 10 marks for a case study of Systems, 10 marks for other methods of PA
PA (I): The faculty may also allocate additional marks out of PA for Practical Work, in addition to the regular practicals. This work may be as follows:

(i) Practical work planned by students, with the approval/ guidance of the students.
(j) Preparation of a case study on a present day electronic system of choice.

ESE Pr (V):10 marks for Open Ended Problems, 20 marks for VIVA.

Note: Passing marks for PA (M) will be 12 out of 30.
Passing marks for ESE Pract(V) will be 15 out of 30.
Passing marks for PA (I) will be 15 out of 30