Sankalchand Patel University

Faculty of Engineering and Technology
Second Year Bachelor of Technology
3rd Semester Electrical Engineering
In Effect from Academic Year 2017-18

Subject Code: 1ET1020303	**Subject Title: Analog and Digital Electronics (ADE)**
Prerequisite Subject	Fundamental Knowledge of Semiconductor physics and Basic Electronics are required

Course Objective:

- This subject focuses on the study of Analog and digital electronics. It details the students about use of Analog and digital electronics in Microprocessors and Microcontrollers and Its application in various electrical related fields like Power system protection, instrumentation, power electronics, Electrical Drives and control of Electrical Equipments.

Teaching Scheme (Hours per week)				**Evaluation Scheme (Marks)**				
				Theory		**Practical**		
Lecture	**Tutorial**	**Practical**	**Credit**	**University Assessment**	**Continuous Assessment**	**University Assessment**	**Continuous Assessment**	**Total**
4	-	2	5	70	30	30	20	150

Subject Contents			
Sr. No	**Topic**	**Total Hours**	**Weight (%)**
1.	**Op-amp basics** Introduction, Block diagram representation of a typical op-amp,ICC circuits, types, designations, packages, pin configurations and power supplies. Concept of ideal op-amp including its ideal voltage transfer curve, equivalent circuit, open loop op-amp configurations of differential, inverting and non-inverting amplifiers, Op amp parameters - offset voltages and currents, bias current, PSRR, CMRR, Slew Rate.	8	16
2.	**Feedback Amplifiers** Concept of positive feedback and negative feedback in op-amp,Op-amp feedback amplifier analysis, differential amplifier with one and two amps.	6	12
3.	**Op-amp and Non linear ICs applications** Op-amp as Summing, scaling and averaging amplifiers, Instrumentation Amplifier: typical block diagram of an Instrumentation Amplifier,Instrumentation amplifier using transducer bridge, op-amp as an integrator, op-amp as a differentiator, Functional diagram of 555 Timer IC including its monostable (one shot) mode and astable (free running) mode,block diagram of PLL system and its applications, 78XX and 79XX series three terminal voltage regulator Ics, LM317 Adjustable Voltage Regulator IC.	10	20
4.	**Number System and Codes** Decimal, Binary, octal, and hexa-decimal number systems and their arithmatic. Number based conversion, its Arithmatic and Complements, Binary code, excess-3 code, gray code, error detection and correction codes, Conversion and its Arithmatic	8	15
5.	**Logic Families and Boolean Algebra** Positive logic and Negative Logic, AND, OR, NOT, NAND,NOR, X-OR GATE, electrical characteristics, ntroduction, Logic Operators, Postulates and theorems, properties, Converting Boolean expressions to Logic and Vice versa, NAND and NOR implementation, Product of Sums and Sum of Products, Karnaugh Map method – 2,3,4,5 variable K-maps, Don't-Care conditions	8	15
6.	**Combinational Logic Circuits** Half and full Adder, Half and full Subtracter, Binary parallel adder, BCD Adder, Magnitude comparator (1 – bit, 2 – bit, 4 – bit only) – Encoders (Octal to Binary, Decimal to BCD) & Decoders (3 x 8, 4 x 16, BCD to Decimal), Multiplexers (2, 4, 16 input), De-multiplexer (1 x 4, 1 x 8), BCD to 7 Segment	5	9

7.	**Flip-Flops & Sequential Circuits** Basic difference between Combinational logic and Sequential logic, Flip-Flops like S-R , J-K, D, Master Slave– Triggering of (Level and Edge triggered) flip-flops, Asynchronous and Synchronous Inputs –Excitation tables for flip-flops; Counters, Registers, Shift Registers (SISO, SIPO, PISO, PIPO)	5	9
8.	**Digital to Analog and Analog to Digital Converters** Role of Memory in Computer Systems and their types, Analog to Digital (A/D)Converters, Digital to Analog (D/A) Converters, Converter applications	2	4

List of References:

1. Fundamentals of Digital Electronics by A. Anandkumar, PHI
2. Digital Electronics Principal and Integrated Circuits by Anil K. Maini, WILEY-INDIA
3. Digital Logic and Computer Design by M. Morris Mano, PHI
4. Digital Computer Electronics by Malvino & Brown, Tata McGraw Hil
5. Ramakant A Gayakwad, Op- Amps and Linear Integrated Circuits, Prentice Hall of India
6. U. A. Bakshi and A. P. Godse, Analog Electronics, Technical Publications

Course Outcome:

After learning this course, the students should be able to:

1. Understand different number systems and its inter-conversions.
2. Understand the concept of Boolean algebra and its different theorems, properties etc.
3. Understand simplification of Boolean functions.
4. Understand the construction and working of different combinational circuits etc.
5. Understand different flip-flops and its applications.
6. Understand different sequential logic circuits and basic design of sequential circuits and counters.
7. Understand different types of memories and its applications.
8. Understand the fundamentals of D/A and A/D converters.
9. Understand the basics of Analog Electronics.
10. To test circuits with op-amps and other electronics components for different applications.
11. To test various circuits using different Ics.

List of Experiments :

List of Suggested Analog Electronics Practicals

1. Op-amp as an inverting amplifier.
2. Op-amp as non-inverting amplifier.
3. Op-amp circuit as an integrator.
4. Op-amp circuit as a differentiator.
5. 555 Timer IC – Astable mode operation.
6. 555 Timer IC – Monostable mode operation.
7. Verify the operation of IC 78XX and IC 79XX as a 12V voltage regulator.

List of Suggested Digital Electronics Practicals

1. Develop understanding of number systems and Boolean algebra.
2. Understand the functioning of logic gates, their implementation and verification of truth tables.
3. Develop the understanding of the working of different combinational logic circuits.
4. Understand and verify the working of various sequential logic circuits.
5. Understand simulation tools for digital logic circuits and simulation of digital logic circuits.
6. Understand logic analyzer for testing the logic circuits.
7. Understand and verify the working of Various Types of D/A and A/D converters

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Directions for Laboratory work:

- The list of experiments is given as a sample.
- Minimum 10 experiments should be carried out.
- At least one experiment should be selected from each group.
- Similar laboratory work fulfilling the objectives can also be considered.
- Each experiment should be simulated before verifying practically.
- As far as possible, printed manual should be preferred so that students can concentrate in laboratory experiments and related study.

List of Open Source Software/learning website for Analog Electronics:

Open Source Sfteware:

- LTSpice for circuit simulation,
- KiCAD for CAD application

Web-base tools for design:

- http://www.fairchildsemi.com/support/design-tools/power-supply-webdesigner/

- http://www.ti.com/lsds/ti/analog/webench/overview.page

Circuit Lab:

- https://www.circuitlab.com/editor/

Open source for Math Tools:

- http://maxima.sourceforge.net/

- http://www.sagemath.org/

- http://www.scilab.org/

- http://www.gnu.org/software/octave/

Learning website

- http://www.electrical-engineering-portal.com/

- http://nptel.iitm.ac.in/courses.php

List of Open Source Software/learning website for Digital Electronics:

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