

COURSE TITLE	ANALOG AND DIGITAL ELECTRONICS
COURSE CODE	01EE2302
COURSE CREDITS	4

Objective:

- 1 Introduce learner to basic analog and digital electronic circuits used in practice for different applications or as building blocks of complex circuits

Course Outcomes: After completion of this course, student will be able to:

- 1 Explain various terminologies related to analog and digital circuit
- 2 Implement Op-Amp configurations to perform analog signal processing tasks.
- 3 Construct various signal generators using 555 timers and Op-Amps
- 4 Develop a combinational circuit using different basic digital circuits
- 5 Analyze operation of various sequential circuits and determine their role in modern computers

Pre-requisite of course: Basic Electronics

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Differential, multi-stage and operational amplifiers Differential amplifier; direct coupled multi-stage amplifier, internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product), Datasheet of OP-AMP 741, 555 Timer and its applications: Pin diagram and function of 555, Block diagram, Monostable and Astable multivibrator, Application of 555 Timer	6
2	Linear applications of op-amp Idealized analysis of op-amp circuits. Opamp with negative feedback, Inverting and non-inverting amplifier, Summing, Scaling and Averaging Amplifier, differential amplifier, instrumentation amplifier, Integrator, Differentiator, Active filters – First Order Low Pass Butterworth Filter, Second Order Low Pass Butterworth Filter, First Order High Pass Butterworth Filter, Second Order High Pass Butterworth Filter, Band Pass Filter	10

Contents : Unit	Topics	Contact Hours
3	Nonlinear applications of op-amp op-amp as comparator, Hysteresis Comparator, Schmitt Trigger, Zero Crossing Detector, Square-wave and triangular-wave generators, Wein bridge oscillator, Phase Shift oscillator, Precision rectifier, peak detector	6
4	Boolean Algebra and Logic Simplification Number System – Binary and Hexadecimal Number System, BCD Numbers, Boolean Operation and Expressions, Laws and Rules of Boolean Algebra, De Morgan's Theorem, simplification Using Boolean Algebra, Boolean Expressions and Truth Tables	4
5	Combinational Digital Circuits Standard representation for logic functions – SOP and POS expression, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer, Encoders, Decoders, Adders, carry look ahead adder, BCD arithmetic, BCD to 7-segment decoder, digital comparator, code converters, ALU, elementary ALU design	8
6	Sequential circuits and systems A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, JK, T-type and D type flip-flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design, Introduction to Finite State Machines – Mealy and Moore Machines	8
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment-1 Generation of square wave signal using 555 Timer astable multivibrator.	2
2	Experiment-2 Study of op-amp as inverting amplifier and non-inverting amplifier	2
3	Experiment-3 Frequency response of inverting amplifier and non-inverting amplifier	4
4	Experiment-4 Verification of Performance of OPAMP as Comparator and Zero Crossing Detector.	2
5	Experiment-5 Verification of Performance of OPAMP as integrator and differentiator,	2

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
6	Experiment-6 Waveform generation – Square, triangular and saw tooth wave form generation using OPAMPs	4
7	Experiment-7 Application of op-amp as low pass filter, high pass filter and band-pass filter.	4
8	Experiment-8 Verification of function of Half/Full adder circuits.	2
9	Experiment-9 Verification of function of Decoder and Encoders	2
10	Experiment-10 Verification of function of Latch and flip-flop. (RS)	2
11	Experiment-11 Verification of counter circuit like binary up/down counter	2
Total Hours		28

Textbook :

- 1 Op- Amps and Linear Integrated Circuits - 4th edition, Ramakant A Gayakwad, Pearson Education, 2015
- 2 Digital Fundamentals - 11th edition, Thomas L. Floyd, Pearson Education, 2021
- 3 Fundamentals of Digital Circuits - 4th edition, A. Anand Kumar, PHI Learning, 2016

References:

- 1 Modern Digital Electronics, Modern Digital Electronics, R. P. Jain, McGraw Hill Education, 2009
- 2 Digital logic and Computer design, Digital logic and Computer design, M. M. Mano, Pearson Education India, 2016

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
20.00	30.00	25.00	15.00	10.00	0.00

Instructional Method:

- 1 The course delivery method will depend upon the requirement of content and the needs of students. The teacher, in addition to conventional teaching methods, may also use any tools such as demonstration, role play, Quiz, brainstorming, MOOCs, etc

Instructional Method:

- 2 The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and classroom
- 3 Practical examinations will be conducted at the end of the semester to evaluate the performance of students in the laboratory
- 4 Students will use supplementary resources such as online videos, NPTEL videos, e-courses, and Virtual Laboratory

Supplementary Resources:

- 1 <https://nptel.ac.in/courses/117/106/117106086/>
- 2 <https://www.coursera.org/learn/electronics>
- 3 <https://www.ti.com/tool/PSPICE-FOR-TI>
- 4 <https://www.multisim.com/>