DAIICT Gandhinagar

EL111 Basic Electronic Circuits

UG Core Course for Autumn 2021-22

Instructors: Prof. Ahlad Kumar and Prof. Srimanta Mandal
Practice Sessions: TAs
Labs: Mr. Krunal Patel and TAs

Tentative List of Topics/Lectures

Lecture No.	Topics
1	Introduction to the course and lab. LTSpice Software.
2	Basic Concept of Electronic Circuits. Active and Passive Circuit Element, Representations of Basic Components. Measuring Resistance Using Color Code. Revisiting some Physical Quantities (Force, Energy, Power, Charge, Current, Potential, Electric Field, Magnetic Flux Density). Introduction to Signals & Systems
3	Linear System. Time Invariant Systems. Continuous Time and Discrete Time Signals. DC, AC. Sinusoidal Signal, Complex Signals. Square Wave. Triangular Wave. Concept of Duty Cycle. Unit Step. Unit Ramp.
4	Ideal Voltage and Current sources. Controlled sources VCVS, VCCS, CCVS and CCCS. Resistors, Resistivity. Conductor, Conductivity, Mobility. Insulator. Semiconductor. Ohm's Law. Capacitor. Inductor
5	DC- Resistive Circuit Analysis, KCL, KVL, Node and Loop Equations solving to find V and I. Cramer's Rule. Gauss-Jordan Method
6	Current Division. Voltage Division. Series and Parallel Combinations. Star-to-Delta Conversion. Delta-to-Star Conversion. Wheatstone Bridge and Basic Measurements with Transducers. Potentiometers.
7	Thevenin and Norton's theorems. Finding V and I in Resistive Circuits with Controlled Sources.
8	Source Transformation. Max Power transfer. Superposition Theorem. Input and Output resistances.

9	Practice Session 1
10	Idea of Integrated Circuits and VLSI. Idea of Amplifiers. OP Amps. Ideal OP Amps. Inverting and noninverting Amplifiers with Resistors.
11	Voltage Amplifiers with multiple OP Amps and Resistors, Adders/ Subtractors, Linear Circuits with OP Amps.
12	Difference Amplifiers, Instrumentation Amp., Transimpedance Amp., Current Source, Applications.
13	Circuits with Resistors and Op Amps. Applications.
14	Practice Session 2
15	AC Signals. Period, Frequency, Amplitude. Periodic signals. Sinusoidal voltages and currents. Average and RMS values. Phase of a Sinusoid, Phase lag and lead. Phasors. Complex numbers and variable basics. Euler's formula.
16	Arithmetic operations with phasors and complex numbers Idea of Impedance. Circuit laws and analysis with Impedances (KVL, KCL, Thevenin, etc. for sinusoidal ac inputs)
17	Idea of Impedances. Circuit laws and analysis with Impedances.
18	Capacitance, Parallel plate capacitors. Storage of Electrostatic Energy. Current voltage relation. Series-parallel connection of capacitors. Inductance, Solenoidal Inductors. Storage of Magnetic Energy, Current voltage relation. Series-parallel connection of inductors.
19	RC circuit analysis with unit step input. Solution of ODE without Laplace Transform, Time Constant and Rise time of RC. Transient and steady state response of first order. RC circuits with switches - Charging and discharging. Time response.
20	LR circuit analysis with unit step input and switches. Time Constant and Rise time of LR. Transient and steady state response of first order. LR circuits with Switches – Current charging and dissipating. RLC circuits with switches – transients and steady state.

21	1st order RC Circuit analysis with sinusoidal input, Steady state response, Change of output with frequency of sinusoid. Frequency response.
22	1st order LR Circuit analysis with sinusoidal inputs, Steady state response, Change of output with frequency of sinusoid. Frequency Response.
23	Compare RC and LR circuits with respect to step and sinusoidal input.
24	Passive R-C Low Pass Filters, High Pass filters. Integrators and differentiators, Active filters using Op Amps (2nd order only).
25	Ideal Transformers. Current, Voltage and power relations between primary and secondary. Impedance relations between primary and secondary.
26	Impedance relations between primary and secondary. Applications of transformers.
27	Practice Session 3
28	Practice Session 4
29	Practice Session 5
30	General Practice Session

READINGS:

1. Lecture Notes
2. J. O'Malley, *Schaum's Outline of Basic Circuit Analysis* 2nd. Ed., McGraw Hill, New York, 1992.
3. R. Dorf and J. Sbovoda, Introduction to Electrical Circuits 6th Ed., John Wiley, 2006.

Lab Classes (Tentative):

Class No.	Date	Topics
1	17-Nov-21	Introduction to LTSpice
2	24-Nov-21	Dependent and Independent Sources, Switches
3	01-Dec-21	Node Voltage and Current Analysis
4	08-Dec-21	Mesh Current Thevenin, Superposition Theorem Source Transformation
5	15-Dec-21	Op-Amp as Non-inverting Amplifier
6	22-Dec-21	Sum and Differential Amplifier
7	29-Dec-21	Experiment with Complex DC Circuit
8	12-Jan-22	Phasor Analysis for R-L, R-C circuits
9	19-Jan-22	KVL, KCL, Thevenin, etc. for sinusoidal ac inputs
10	02-Feb-22	RC, RL with Op-Amps
11	09-Feb-22	Make Up Session
12	16-Feb-22	Lab Exam (Day 1)
13	23-Feb-22	Lab Exam (Day 2)

Format of the Online Course and Evaluation

- For EL111 the semester will start on Oct 25, 2021. It will continue till Mar 03, 2022.

- 2 Online Lectures in Google Meet each of 1.25 hours per week.

- On each Wednesday afternoon (2-5 pm) the Lab will be done by each student in his/her laptop with the help of Mr Krunal Patel and TAs through Google Meet/ Cisco WebEx. Each lab will have a set of 4-5 questions which each student must answer by doing the experiment him/herself. These answers will be submitted as a pdf file each week to serve as a record of attendance and progress. After nine-ten experiments there will be a lab exam with viva through Google Meet. The report of the lab exam should be scanned and sent to us. The contribution of the lab = 20% of Marks.

- Short Quizzes will be conducted frequently to test your comprehension and attention in online classes. These short quizzes will be for 5-10 mins. and carry 5-6 marks from 3-4 questions. These quizzes will be conducted in Google Classroom. Contribution of the Quizzes = 15% of Marks

- In-Sem exam and end-sem exams will be conducted through the Controller's office during the weeks scheduled for such exams (Jan 3-8, 2022, Mar 7-12, 2022). These exams will be proctored as per the policy of DAIICT. These exams will consist of short-answer and multiple-choice questions and carry negative markings. The weightage of the in-sem and end-sem exams are = 20 and 40%, respectively.

- There is a 5% weightage on participation in discussions in class, labs, and practice sessions.