BASIC ELECTRICAL CIRCUITS

PROF. GAJENDRANATH CHOWDARY

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PRE-REQUISITES : XII std. level algebra and calculus, electrostatics

INTENDED AUDIENCE : Interested learners

COURSE OUTLINE :

Electrical circuits are everywhere, from tiny ones in integrated circuits in mobile phones and music players, to giant ones that carry power to our homes. This course deals with analysis techniques that can be applied to all such circuits. We wi will first discuss electrical quantities-voltage and current-relevant to such circuits and learn about basic elements(R, L, C, controlled sources) and their properties. We will then move on to general analysis techniques that can be applied to arbitrary circuits. These will be first carried out for resistive circuits which obey algebraic equations and then extended to circuits with energy storage elements(C, L) which obey differential equations. Along the way, we will also discuss the rudiments of negative feedback circuit using the opamp. After taking this course, one should be able to analyze any linear circuit.

ABOUT INSTRUCTOR :

Prof. Gajendranath Chowdary is a faculty in the department of EE, IIT Hyderabad. He received the B.E. degree from Osmania University Hyderabad, India, in 2006. He obtained the M.Tech and Ph.D. from the Indian Institute of Technology, Delhi, India, in 2008 and 2016 respectively. He worked as an analog circuit design engineer for mobile handsets with ST-Ericsson from 2008 to 2010 and with Aura Semiconductor during 2011, 2013, and 2016. His research interests include analog and mixed-signal circuit design for ultra-low-power applications.

COURSE PLAN :

Week 1: Preliminaries; Current and voltage; Electrical elements and circuits; Kirchhoffs laws, Basic elements: Voltage and current sources, R, L, C, M; Linearity of elements

Week 2: Elements in series and parallel, Controlled sources

Week 3: Power and energy in electrical elements, Circuit Analysis Methods

Week 4: Nodal analysis, Extending nodal analysis with different sources

Week 5: Mesh analysis, Circuit theorems

Week 6: More circuit theorems, Two port parameters

Week 7: Two port parameters continued, Reciprocity in resistive networks

Week 8: Opamp and negative feedback, Opamps contd: Example circuits and additional topics

Week 9: First Order Circuits contd

Week 10: First order circuits with time-varying inputs, Sinusoidal steady state response and total response

Week 11: Second order system-Natural response (continued)

Week 12: Direct calculation of steady state response from equivalent components, Magnitude and Phase plots; Maximum power transfer theorem