WEST VIRGINIA UNIVERSITY

Lane Department of Computer Science & Electrical Engineering

EE 221 Introduction to Electrical Engineering
Spring 2020 - 3 Lecture Credit Hours

Instructor: Dr. Jignesh Solanki
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Office Hours: Scheduled: MW 11:00 AM – 12:00 Noon or by appointment.
Class Time: MWF 01:00 - 01:50 PM **Class Location:** Online using Zoom

Prerequisites: PHYS 111, MATH 156

Co-requisite: Introduction to Electrical Engineering Laboratory (EE 222). If you drop EE 221 you must also drop EE 222. (if applicable to your major)

Required Text: *Fundamentals of Electric Circuit*, 6th Edition by Charles Alexander and Matthew Sadiku, McGraw Hill Higher Education.

Reference Text: *Electric Circuits*, 10th Edition by James W. Nilsson, Susan A. Reidel, Prentice-Hall, Inc.
Engineering Circuit Analysis, 7th Edition, William H. Hayt, Jack E. Kemmerly, and Steven M. Durbin, McGraw-Hill.

Webcam: For quizzes and exams, webcam is required.

Course website: ECampus (http://ecampus.wvu.edu). Instructor is not responsible for lack of access to the website. Please DO NOT wait to the last minute to download course materials.

Recommended Software: MATLAB, MATLAB/Simulink, MATLAB/SimScape Systems, OrCAD/PSPice. You may be required to submit assignments using MATLAB and/or industry leading software.

Expected Learning Outcomes: At the end of this course, a student should be able to:

- Know basic SI units, Calculate charge in electrons
- Calculate current from charge, Know the relationship between power, voltage and current
- Identify passive and active elements in an electric circuit
- Calculate voltage drop, power supplied/absorbed, current flow in a circuit elements
- Understand electricity bills, Learn basic electrical engineering problem solving skills
- Learn to identify nodes, branches and loops in an electric circuit
- Learn Ohm's Law, Kirchoff's Current and Voltage Law
- Apply KCL and KVL in an electric circuit
- Calculate parallel resistors, Apply current and voltage division
- Solve electric circuit using nodal analysis and mesh analysis techniques
- Convert delta network to wye network and vice versa
- Apply superposition principle and source transformation principle to simplify circuit
- Apply Thevenin's and Norton's theorem to represent equivalent circuit
- Calculate current and voltage in/across energy storage elements
- Calculate energy stored in capacitor and inductor

- Use PSPice software to analyze circuit, Use PSPice, MATLAB programming
- Sinusoids and Phasors, Phasor Relationships for Circuit Elements
- Impedance and Admittance, Kirchhoff's Laws in Frequency Domain
- Impedance Combinations, Nodal and Mesh Analysis
- Superposition and Source Transformations, Thevenin's and Norton Equivalents
- Power Calculations

Exam Dates:

Exam 1: Monday 17th February
Exam 2: Monday 8th April

Final Exam: **Tuesday, 5th May 11:00 AM - 1:00 PM – Please check university final exam schedule for any modifications (Regular Classroom)**

Tentative Lecture Topics and Tentative Schedule:

Subject	Chapter
Introduction	
Basic Concepts of Circuit Elements	1
Fundamental Laws of Circuit Theory	2
Linear Circuit Analysis Techniques	3
Circuit Theorems	4
Operational Amplifiers	5
Capacitors and Inductors	6
Sinusoids and Phasors	9
Sinusoidal Steady-State Analysis	10
AC Power Analysis (If time permits)	11

Lecture No.	Subject	Topic	Chapter
1	**Introduction**	Class Policy	
		Introductory Discussion	
2	**Basic Concepts**	Overview, SI Units, Voltage,	1
		Current, Power and Energy	1
3		Sources, Dependent Sources	1
		Applications	1
4		**Martin Luther King**	
5	**Basic Laws**	Resistance	2
		Ohmn's Law	2
6		Nodes, Branches, and Loops	2
7		Kirchhoff's Laws	2
8		Single Loop and Two-Loop Circuits	2
9		Series Resistors and Voltage Division	2
		Parallel Resistors and Current Division	2
10		Wye-Delta Transformations and Applications	2
11	**Methods of Analysis**	Introduction and Nodal Analysis	3
12		Nodal Analysis and Cramer's Rule	3
13		Nodal Analysis with Voltage Sources	3
14		Mesh Analysis and Cramer's Rule	3
		Mesh Analysis with Current Sources	3
15		**Exam#1 Review Class**	
16	**Exam # 1**		

17		Nodal Analysis by Inspection	3
18		Mesh Analysis by Inspection	3
19	**Exam # 1 Solution Discussion**		
20	**Circuit Theorems**	Introduction and Superposition	4
21		Source Transformation	4
22		Thevenin's Theorem	4
23		Thevenin's Theorem and Norton's Theorem	4
24		Norton's Theorem and Maximum Power Transfer	4
25	**Operational Amplifiers**	Characteristics, Inverting Circuits, Summing Circuits	5
26		Non-inverting and Difference Circuits	5
27	**Capacitors and Inductors**	Series and Parallel Capacitors	6
28	**Spring Break**		
29	**Spring Break**		
30	**Spring Break**		
31	**COVID-19 Break**		
32	**COVID-19 Break**		
33	**COVID-19 Break**		
34		Series and Parallel Inductors	6
35	**Sinusoids and Phasors**	Sinusoidal Source	9
36		Phasor and Polar-Rectangular Transformation	9
37		Phasor Relationships – Circuit Elements	9
38	**Exam # 2 (8th April 2020)**		9
39		**Spring Holiday**	
40		Kirchhoff's Laws in the Frequency Domain	**9**
41	**Sinusoidal Steady State Analysis**	Nodal and Mesh Analysis	10
42		Superposition and Source Transformation,	10
43	**Exam # 2 Solution Discussion**		10
44		Thevenin's and Norton Equivalents	
45	**Sinusoidal Steady State Power Calculations**	Instantaneous Power	11
46		Average and Reactive Power	11
47		Apparent Power and Power Factor	11
48		Power Calculations	11

Grading Policy:

Homework Assignments	07%
Writing Assignment	03%
Practice/In Class Problems	20%
Quizzes	20%
Exam I	15%
Exam II	15%
Final Exam	20% (Comprehensive)
	100%

As a general policy, make-up exams will not be given. If there is an extenuating circumstance, you must contact the instructor before the exam and seek approval for granting a make-up exam. Only one makeup exam will be given that will include syllabus from both exams 1 and 2. *The letter from the University is required for excused absence and make up exam.* It is up to the instructor's discretion to accommodate student for missed exams.

Semester Grade: $90 \leq A \leq 100$ $80 \leq B < 90$
$70 \leq C < 80$ $60 \leq D < 70$
$F < 60$

Homework will be due at the **beginning** of class on the assigned date. Homework problems will be assigned may not be from the text. You are encouraged to discuss the homework problems with other students in the class; however, the discussion must end when you write your solution. Thus, the work on the paper must be your work. Late homework will not be accepted.

Other Policies: Please bring your own calculators every day. Please make sure you switch off laptops, cellphones and be considerate to your fellow class mates by maintaining silence. Failure to adhere to these policies will result in loss of grade without notice. During exams scramble the usual positions you sit in and keep the bags near the blackboard. You can bring one A4 formula sheet without figures, texts, tables and numbers and make sure you attach the sheet to the exam. Cellphones, smart watches or smart devices that communicate outside or inside of classroom will not be allowed during exams. If caught cheating University cheating policy will be enforced. Do your own honest work.

You are responsible for all material assigned in text and covered in class: All students are responsible for all material covered in class as well as all announcements. Private lectures will not be given over class material missed by absence. Let the instructor know in advance of any excused absences.

Do work we can all be proud of: As a student in engineering, you are preparing for a professional career. You should be developing attitudes and skills appropriate for the profession while you are in school. The quality of work you submit for evaluation reflects on you and your professional status. In particular, homework submissions should be considered as professional work. Each page should have your name, course, and date at the top with the pages stapled together. Except for very short problems, each problem should begin on a new page. Use only one side of the paper. The problem number and parts of a problem should be clearly indicated. The problem answers should be clearly marked with a box. Units must be indicated.

Above all, your work should be well organized and easy to follow. The evaluator should quickly understand your procedure and find the results in a logical location. Documentation of the process using comments is appropriate, but should be direct and terse. Mundane details of intermediate calculations can be omitted without loss of clarity. Unprofessional, sloppy, poorly organized, or poorly presented work will be downgraded.

STUDENTS WITH DISABILITY:

If you have a disability and anticipate needing any type of accommodation in order to participate in this class, please advise the instructor and make appropriate arrangements with Disability Services (293-6700). The student should notify the instructor during the first week of class regarding the accommodation needed.

SOCIAL JUSTICE STATEMENT:

West Virginia University is committed to social justice. I concur with that commitment and expect to foster a nurturing learning environment, based upon open communication, mutual respect, and non-discrimination. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration. If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with Disability Services (293-6700). If you feel that you are being treated inappropriately or unfairly in any way, please feel free to bring your concerns to my attention. Please be assured that doing so will not prejudice the grading process. In return, I expect you to behave professionally and ethically. Grades will be based on performance, but will be lowered for unethical or unprofessional conduct.

RELIGIOUS OBSERVANCES:

WVU recognizes the diversity of its students, some of whom must be absent from class to participate in religious observances. You must, however, notify me in writing by the end of the third class meeting regarding religious observances that will affect your attendance. I will make reasonable accommodation for in-class problems or quizzes that you will miss as a result of religious observance, provided I am informed at least one week in advance.

ACADEMIC DISHONESTY:

WVU expects that every member of its academic community shares the historic and traditional commitment to honesty, integrity, and the search for truth. Academic dishonesty is defined to include but is not limited to any of the following: ***cheating and dishonest practices*** *in connection with examinations, papers, and projects;* ***forgery, misrepresentation, or fraud; and plagiarism.*** *If we are able to document that you have been dishonest academically in any of the ways described, you will be subject to procedures and penalties as prescribed in the WVU Student Code of Conduct http://www.arc.wvu.edu/admissions/integrity.html*

Note: The content of this syllabus may be changed anytime according to the instructor's discretion.