PABLO

COURSE OUTLINE8

ELNG 153: Fundamentals of Electrical Engineering (3 credit)

Semester 1: 2021/22

Class Hours: 7:00 – 8:55

Venue: LT 1

Facilitator: Ing. Nana Twum Duah (MIET, PE-GhIE)

Teaching Assistance: Dennis A. Akuetteh

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Office Hours:

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Prerequisite Course (s): Physics and Elective Mathematics.

Required Text (s):

- Boylestad R., Introductory Circuit Analysis, ISBN 9780133923605, 978129098951
- C. K. Alexander, M. N.O. Sadiku, Fundamentals of Electric Circuits, ISBN 978-0078028229
- Hughes E. , Electrical and Electronics Technology(10ed.,Pearson Education), ISBN 8131733661, 9788131733660
- Theraja B.L, Theraja R.K, A Text Book of Electrical Technology, ISBN 8121924413, 9788121924412
- Giorgio R., James K, Fundamentals of Electrical Engineering.
- ELNG 153, Fundamentals of Electrical Engineering hand book.

Course Description

Units and Measurement: Basic and Derived Units, SI Units, Definition of Work, Energy and Power, Efficiency, Number Systems, Introduction to Types of Signals and Systems.

Passive Elements: Resistors, Capacitors and Inductors

Introduction to Electrical Circuits: Ohm's Law, Kirchhoff's Laws, Series and Parallel connection, superposition and reciprocity theorems.

AC Circuits: AC in inductive, resistive and capacitive circuits, complex number representation of AC parameters, Single and Three phase AC circuits.
Simple Magnetic Circuits: Magnetism, Ohm's law for magnetic circuit; Analogy between electric circuits and Magnetic Circuits

Course Objectives:

By the end of the course student will be able to;

- Solve simple DC and AC electrical circuit using Kirchhoff's Laws, Superposition and reciprocity theorems.
- Solve three phase balanced System.
- Compute apparent, real, and reactive and power factor of a complex load for single and three phase system
- Calculate the flux, flux density, and magnetic field intensity, and currents in simple magnetic structures

Course Content

Unit 1: Units of measurement, Electrical Quantities, Introduction to Passive elements; Resistors, Capacitors, Inductors.
Unit 2: Ohm's Law, Work, Energy and Power, Efficiency, ideal sources, Open and short circuits.
Unit 3: Kirchhoff's Laws, Current and voltage divider rule, electrical network elements, Series and Parallel connection, Wye to delta Conversion
Unit 4: Superposition and reciprocity theorems.
Unit 5: Sinusoidal AC voltage, Sinusoidal wave, response of Basic R, L, and C elements
Unit 6: Method of Analysis AC circuits, Power in AC, Power factor, resonance
Unit 7: Three Phase systems, balance, Non-sinusoidal circuits, Fourier series
Unit 8: Magnetism, Ohm's law for magnetic circuit; Analogy between electric circuits and Magnetic Circuits

Teaching and Learning Strategies

Lecturers, Tutorials, group work, laboratory work

Assessment

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A combination of formative and summative assessment including group tasks, quizzes, Midsem, assignments and examination will be used.

Assessment weighting

End-of-semester examination/ Term Paper:	60%
Midsem	15%
Quiz 1	5%
Quiz 2	5%
Quiz 3	5%
Quiz 4	5%
Assignments	5%
Class participation	Bonus Mark

Course Policy

Submit class assignment to the TA before lecture begins - deliberates with students' punishment for late submission

Class attendance will be taken every lecture

Students should not be 5 minutes late for a lecture – agree on punishment with students

Immediately Ask questions on something you don't understand

Contact me through my TAs or email. Contact me directly only during emergency situations.

Week	Content	Objectives	Activities	Resources
1	i. Introduction and overview of course ii. Units of measurement	• Describe the aims of the course and its importance as a foundation course in the programme.	Review of prerequisite courses Facilitator's presentation	PPT of ELNG 153 Lecture notes 1

	i. Electrical Quantities,	• Know SI units and its importance. • Understand prefixes and how is properly used. • Perform simple calculations involving SI units. • Explain Current and Voltage •	and whole class discussion.	
2	ii. Introduction to Passive elements; Resistors, Capacitors, Inductors. iii. Introduction DC and AC sources iv. Ohm's Law, Energy Power and Efficiency, Open and short circuits	• Describe Resistors, Capacitors, Inductors. • Calculate the energy stored in capacitor ad inductor • State and apply Ohm's law. • Explain electrical power, work and energy, and perform simple calculations involving them • Identify ideal sources • Know the application of open and short circuit	Facilitator's presentation and whole class discussion	PPT of ELNG 153 Lecture notes 1/2
3	Quiz 1	• Text students understanding on	whole class discussion	PPT of ELNG 153

	Features of electric circuits or networks, Kirchhoff's Laws,	topics learnt from week 1 – 3 • Identify the principal features of electric circuits • Apply Kirchhoff's Laws to simple electric circuits • Apply the passive sign convention to compute the power consumed or supplied by circuit elements	Facilitator's presentation and whole class discussion	Lecture notes 2
4	quiz 2 Series and Parallel connection, Current and voltage divider rule, Wye to delta Conversion Wye to delta Conversion, superposition and reciprocity theorems.	• Apply voltage and current divider rule in electrical circuit • Identify series and parallel connections in a network • Perform Wye to delta Conversion, • Apply Superposition and Reciprocity theorem in dc electrical circuits. •	Facilitator's presentation and whole class discussion	Questions from reference books PPT of ELNG 153 Lecture notes 2/3
5	Quiz 3	• Appreciate why AC is used in Preference to DC.	Facilitator's presentation and whole	PPT of ELNG 153 Lecture notes 4

	Sinusoidal AC voltage, Sinusoidal wave, Introduction to phasors, response of Basic R, L, and C elements	• Define Sinusoidal AC voltage and its characteristics • Calculate period and frequency of waveform • Derive the average and RMS value of sinusoidal signal. • Calculate peak, mean and rms values of a sine wave. • Apply phasors • Derive formulae for the response of basic L, R and C elements to a sinusoidal voltage and current	class discussion	
6	Mid sem	•		
7	Introduction to complex numbers, Method of Analysis AC circuits, Power in AC, Power factor, resonance	• Solve AC circuits using complex numbers • Solve AC circuits using Kirchhoff's and superposition's theorem • Understand the meaning of instantaneous and average power.	Facilitator's presentation and whole class discussion	PPT of ELNG 153 Lecture notes 4/5

		• Compute the power factor of a complex load. • compute apparent, real, and reactive • power for complex loads. Draw the power triangle • Explain Resonance		
8	quiz 4 Three Phase systems, balance three phase, Introduction to Non-sinusoidal circuits, Fourier series	• Learn three-phase AC power notation; compute load currents and voltages for balanced wye and delta loads. • Explain Non-sinusoidal signal • Apply Fourier analysis to Non-sinusoidal circuits •	Facilitator's presentation and whole class discussion	PPT of ELNG 153 Lecture notes 6
9	Magnetism, Ohm's law for magnetic circuit; Analogy between electric circuits and Magnetic Circuits	• Review the basic principles of magnetism • Use the concepts of reluctance and magnetic circuit equivalents to compute magnetic flux and currents in simple magnetic structures	Facilitator's presentation and whole class discussion	PPT of ELNG 153 Lecture notes 7

		• Generate the equivalent magnetic circuit diagram, and calculate the total equivalent reluctance • Calculate the flux, flux density, and magnetic field intensity.		
10		End of Semester		
11				