

## Lesson Plan: EE321

<b>Subject</b>	Electrical Measurements & Instrumentation					<b>Subject Code</b>		EE321
<b>Semester/year</b>	1/2016					<b>Date Prepared</b>		08/02/2016
<b>Lecturer(s)</b>	Mr. Lolong Bonner/Mr. Solomon Guise					<b>Credit Hours (PNG standard)</b>		0.9
<b>Period</b>	15 weeks					<b>Credit Hours (Engineering Accreditation Standard)</b>		0.2
<b>Subject Synopsis</b>	This subject studies processes of measurements of electrical variables/parameters using standard instrumentation/measurements systems. It covers fundamental units, standards; Recording, analysis and stating of measurements with acceptable degree of accuracy/errors: absolute, relative, systematic, random, FSD error. Error of complex method. Error calculations. The subject also studies the main categories of measurement instruments/systems: construction, principles of operation and applications: Moving coil instruments. Moving iron instruments. Dynamometer instruments. Dynamometer wattmeter. Induction instruments. Energy meter. Instrument transformers. Single and three phase power and energy measurements. DC and AC bridges.							
<b>Contact hours</b>	Lecture: 2 hours/week Lab: 3 hour/week (average)							
<b>Evaluation</b>	Continuous assessment 100 %							
<b>Learning Outcomes</b>	On completion of this subject, students will be able to: <ul style="list-style-type: none"><li>• Evaluate, Analyze..... Define, explain and calculate errors: absolute, relative, systematic, FSD and random errors.</li><li>• Apply.....<ul style="list-style-type: none"><li>○ current and voltage transformers for three phase measurements and protection applications.</li><li>○ bridges for RCL measurements.</li><li>○ Measure power in single and three phase systems, for balanced and unbalanced load and for any waveshape, using dynamometer wattmeters.</li></ul></li><li>• Understand....<ul style="list-style-type: none"><li>○ Explain principle of operation and applications of moving coil, moving iron, dynamometer and induction instruments.</li><li>○ Explain structures, principles of operation and applications of <i>current transformer</i> (CT) and <i>voltage transformer</i> (VT).</li></ul></li></ul>							
<b>Assessment Methods</b>	Distribution	(%)	LO1	LO2	LO3	LO4	LO5	
	Assignment (4)	20	x	x				
	Quiz (4)	10	x					
	Labs (4)	20	x			x		
	Tests (4)	50	x	x	x	x	x	
<b>References Used in Class</b>	Gregory, B . A., An Introduction to Electrical Instrumentation and Measurements Systems, Macmillan, 1982							
<b>Additional References</b>	Supplementary reference Material if any							

## Program Outcomes (Electrical and Communications Engineering)

PO1	An ability to apply the knowledge of mathematics, science and Engineering in all aspects of Electrical Engineering.
PO2	An ability to design and conduct experiments, as well as to analyse and interpret data.
PO3	An ability to design a system, component, or process to meet desired need within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
PO4	An ability to apply the techniques of using appropriate tools to investigate, analyse, design, simulate and/or fabricate/commission complete systems.
PO5	An ability to identify, analyse, formulate, design, simulate and/or fabricate/commission complete systems for engineering problems.
PO6	An ability to communicate effectively and to prepare formal technical plans leading to solutions and detailed reports for electrical systems.
PO7	An ability to work on multidisciplinary teams and comprehend his/her scope of work, deliverables and issues in which able to lead the team towards goal.
PO8	Possess an understanding of professional, safety and ethical responsibility.
PO9	Broad understanding of the impact of engineering solutions in a global, economic, environmental, and societal context.
PO10	Recognition of the need for, and an ability to engage in life-long learning to upgrade to higher learning and research activities.
PO11	Comprehensive knowledge of contemporary issues due to changing technical scenario.
PO12	An ability to manage projects in multidisciplinary environments and apply management techniques, skills, and project management tools necessary for engineering practice.

Chapter	Topic	Week	Topic Outcomes (TO)	LO	PO	Delivery Methods
	Measurement Units & Systems	1-3	CGS MKSA SI Metric System Imperial System Fundamental Units Derived Units	LO1		Lecture/ Tutorial
	Standards	4-5	Classifications: International, Primary, Secondary Electrical Standards: Ampere, Volt, Ohm, Farad, Henry, Hertz,	LO1		Lecture/ Tutorial
	Measurements & Errors Analysis	6-7	Categories/Classifications of Errors: Error Calculations: Mean, Standard Deviation – RMS.	LO3		Lecture/ Tutorial
	Instrumentation Systems Overview	8	Analog Instruments Digital Instruments Sensors & Transducers	LO3		Lecture/ Tutorial
Mid-Term Break						
	Analog Instruments	9-10	<ul style="list-style-type: none"> <li>Moving Coil Instruments</li> <li>Moving Iron Instruments</li> <li>Dynamometers</li> <li>Induction Instruments <ul style="list-style-type: none"> <li>Constructions</li> <li>Principles of Operations</li> <li>-Specifications &amp; Limitations/Capabilities</li> <li>Applications</li> </ul> </li> </ul>	LO4		Lecture/ Tutorial/Lab

	Energy Measuring Instruments	11-12	Wattmeters 1-phase measurements, 3-phase power and phase measurements and analysis -balanced loads -unbalanced loads	LO4		Lecture/ Tutorial/Lab
	Instruments Transformers	13-14	Current Transformer Voltage Transformer	LO4		Lecture/ Tutorial/Lab
	Bridges: DC & AC	15	DC Bridges – The Wheatstone Bridge AC Bridges Capacitance Bridges Inductance Bridges	LO4		Lecture/ Tutorial/Lab

Assessment Details			
Type	Group/ Individual	Learning Domain	Mark
Assignments	Individual		20
Quizzes	Individual		10
Labs	Group		20
Tests	Individual		50

#### Assessment schedule:

		Week N <sup>o</sup> :														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Assessment Methods	Assignments			x				x			x			x		
	Quizzes							x			x		x		x	
	Labs							x		x		x			x	
	Tests									x			x		x	

#### LO-PO mapping:

		Programme Outcomes (POs)											
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
Learning Outcomes LOs	LO 1	x				x							
	LO 2	x	x			x							
	LO 3	x	x		x	x							
	LO 4	x			x	x							
	LO5	x	x	x	x	x							

Prepared By: Lolong Bonner

Checked & Approved By:

Date:

(Head of the department ECE)

Date:

**Remarks:**

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