Subject Description Form

Subject Code	EE2002 / EE2002A / EE2002B
Subject Title	Circuit Analysis
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Pre-requisite: AP10006
Objectives	1. Introduce fundamental circuit theory. 2. Develop ability for solving problems involving electric circuits. 3. Develop skills for experimentation on electric circuits.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Acquire a good understanding of fundamental circuit theory. b. Solve simple problems in electric circuits. c. Use suitable instrumentation to carry out experimental investigations to validate the theoretical investigations.
Subject Synopsis/ Indicative Syllabus	**Syllabus:** 1. Capacitance, Inductance and First Order Transients Constitutive relations of capacitor and inductor. Energy stored in capacitor and inductor. Introduction to time-varying circuits. Simple RC and LC circuits. Important concept of independent state variables. First-order differential equation (with simple solution of exponential form). First order transient analysis. Time-domain solution and transient behaviour of first order circuits. 2. Steady-state Analysis of AC Circuits Phasors (rotating vectors). Steady-state analysis of circuits driven by single fixed frequency sinusoidal sources. Impedance and admittance. Analysis approach 1: phasor diagrams for simple RLC circuits. Analysis approach 2: systematic complex number analysis, i.e., same treatment as DC circuits but with complex numbers representing phase and magnitude of AC voltages and currents. Three-phase start connection. Three-phase delta connection. Line and phase voltage, line and phase current for three-phase circuits. Theorem of conservation of complex power. 3. Power in AC Circuits Average and rms values. Complex, real, reactive, and apparent powers. Lagging, leading power and unity power factor. Effects of poor power factor. Power factor correction. Theorem of conservation of complex power. 4. Mutual Inductance and Transformer Basic coupled inductance equation. Concept of ideal transformer (assuming sinusoidal voltages and currents). Dot convention. Transformer matching for maximum power transfer. Physical transformer as ideal transformer with leakage and magnetizing inductances. Applications in galvanic isolation and voltage/current level conversion.

5. Electrical Measurement

Measurement uncertainties. Resistance measurement: Four-probe measurement and Wheatstone Bridge. Capacitance and inductance measurement using AC Bridges. Power Measurement. Measuring three-phase power by two-wattmeter method.

Laboratory Experiments:

1. Basic Instrumentation
2. Kirchhoff's laws and the maximum power transfer theorem
3. RC and RL circuits

Teaching/ Learning Methodology

Lectures, supplemented with interactive questions and answers, and short quizzes	a, b	In lectures, students are introduced to the *knowledge* of the subject, and *comprehension* is strengthened with interactive Q&A and short quizzes.
Tutorials, where problems are discussed and are given to students for them to solve	a, b	In tutorials, students *apply* what they have learnt in solving the problems given by the tutor.
Laboratory sessions, where students will perform experimental verifications. They will have to record results and write reports on the experiments.	b, c	Students *acquire* hands-on experience in using electronic equipment and *apply* what they have learnt in lectures/tutorials to experimentally validate the theoretical investigations.
Assignment	a, b	Through working assignment, students will develop a firm understanding and *comprehension* of the *knowledge* taught.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/task	% Weighting	Intended Subject Learning Outcomes to be Assessed		
		a	b	c
1. Continuous Assessment (Total 50%)				
▪ Assignment	16%	✓	✓	
▪ Laboratory works and reports	18%	✓	✓	✓
▪ Mid-semester test/Short quizzes	16%	✓	✓	
2. Examination	50%	✓	✓	
Total	100%			

	<table><tr><td>Specific assessment methods/task</td><td>Remark</td></tr><tr><td>Assignment</td><td>Assignments are given to students to assess their competence level of *knowledge* and *comprehension*. The criteria (i.e. *what* to be demonstrated) and level (i.e. the *extent*) of achievement will be graded. Feedback about their performance will be given promptly to students to help them improvement their learning.</td></tr><tr><td>Laboratory works and reports</td><td>Students will be required to perform three experiments and submit reports on the experiments. This is to evaluate the students' problem solving techniques, ability to apply what they have learnt, and organization skills.</td></tr><tr><td>Mid-semester test/ Short Quizzes</td><td>There will be a mid-semester/short quizzes test to evaluate students' achievement of all the learning outcomes and give feedback to them for prompt improvement.</td></tr><tr><td>Examination</td><td>There will be an examination to assess students' achievement of all the learning outcomes. These are mainly summative in nature.</td></tr></table>
Student Study Effort Expected	<table><tr><td>Class contact:</td><td></td></tr><tr><td>▪ Lecture/Tutorial</td><td>30 Hrs.</td></tr><tr><td>▪ Laboratory</td><td>9 Hrs.</td></tr><tr><td>Other student study effort:</td><td></td></tr><tr><td>▪ Revision and Assignments</td><td>52 Hrs.</td></tr><tr><td>▪ Report Writing</td><td>14 Hrs.</td></tr><tr><td>Total student study effort</td><td>105 Hrs.</td></tr></table>
Reading List and References	**Textbook:** 1. C.K. Alexander and M.N.O. Sadiku, Fundamentals of Electric Circuits, 6th Edition, New York: McGraw-Hill, 2017. **References:** 1. G. Rizzoni and James Kearns, Principles and Applications of Electrical Engineering, 6th Edition, New York: McGraw-Hill, 2016. 2. W.H. Hayt, J.E. Kemmerly and S.M. Durbin, Engineering Circuit Analysis, 9th ed., New York: McGraw-Hill, 2018. 3. A.H. Robbins and W.C. Miller, *Circuit Analysis: Theory and Practice*, Thomson Learning, 5th ed., 2013.