Subject Description Form

Subject Code	EE2902S (Co-taught by EE and EIE)
Subject Title	Fundamentals of Electrical and Electronic Engineering
Credit Value	3
Level	2
Pre-requisite/ Co-requisite/ Exclusion	Nil
Objectives	1. To introduce students to the fundamental principles and analysis techniques of basic electrical devices and circuits. 2. To introduce students to the fundamental principles and analysis techniques of basic electronic (semiconductor) devices and circuits.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: 1. Understand the fundamental principles and analysis techniques of basic electrical devices and circuits. 2. Understand the fundamental principles and analysis techniques of basic electronic (semiconductor) devices and circuits.
Subject Synopsis/ Indicative Syllabus	**DC Electrical Circuits —** How electricity works. Electromechanical analogies. Common Prefixes. Atoms and atomic structure. Basic electric quantities: charge, potential, current, voltage, power, and energy. Resistance, Ohm's law, and resistors. Resistors in series and in parallel. Sign convention. Practical, ideal, independent, and dependent voltage and current sources. Voltage and current dividers. Use of basic test meters: voltmeters, ammeters, ohmmeters, and multimeters. Lumped circuit elements. Network description: branch, node, loop, and mesh. Kirchhoff's voltage and current laws. Tellegen's theorem. Mesh-current and node-voltage methods. Thévenin's and Norton's theorems. Loading effect and maximum power transfer. **AC Electrical Circuits —** The war of the currents. AC versus DC. Time-dependent, periodic, and sinusoidal signals. Sinusoidal sources. Worldwide mains electricity. Peak, average, and root-mean-square values. Inductors and capacitors. Sinusoidal steady-state analysis by time-domain method. Complex number. Euler's identity. Phasors and phasor diagrams. Impedance and admittance. Sinusoidal steady-state analysis by phasor–impedance method. Power, energy, and electricity bill. Instantaneous and average powers. Power in resistive, inductive, capacitive, and complex loads. Complex power and power factor. Power generation, transmission, and distribution. Three-phase power basics. Single (split)-phase three-wire source. Star (wye)-connected three-phase four-wire source. Star–star and star–delta source–load connections. Star–delta transformations. **Diodes and Diode Circuits —** P–N junction diodes: symbol, ideal *I–V* characteristics, forward and reverse biases, ON and OFF states, ideal diode equation, DC model, load line and graphical analysis techniques, piecewise linear model, small-signal diode model, breakdown characteristics, Zener diodes. Diode circuits: half-wave rectifiers, full-wave rectifiers, filters and ripple voltages, Zener diode circuits, source regulation, load regulation, clipping circuits, clamping circuits. **Transistors and Transistor Amplifiers —** Bipolar junction transistors (BJTs) and field-effect transistors (FETs): symbols, modes of operation, input and output characteristics. BJT and FET circuits: DC analysis, load line, Q-point, various DC

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<tr><td></td><td>biasing schemes, bias stability. BJT and FET amplifiers: small-signal parameters, basic amplifier configurations, operations, characteristics, AC analysis, load line, design techniques, small-signal equivalent circuits and circuit parameters, small-signal voltage gain, small-signal current gain, input resistance, output resistance, loading effect, maximum symmetrical swing.</td></tr>
<tr><td>Teaching/Learning Methodology</td><td>The key concepts, principles, and techniques covered in this subject are discussed in lectures and tutorials. Emphases on fundamental understanding and practical problem-solving techniques are balanced. To strengthen understanding, students will have chances to make discussions and to do hands-on exercises both in the lectures and tutorials. Individual assignments, quizzes and/or tests consisting of descriptive and analytical problems are involved to allow students to recognize their level of understanding and to create self-confidence in learning.</td></tr>
<tr><td>Assessment Methods in Alignment with Intended Learning Outcomes</td><td>
<table>
<tr><td rowspan="2">Specific assessment methods/tasks</td><td rowspan="2">% weighting</td><td colspan="2">Intended subject learning outcomes to be assessed</td></tr>
<tr><td>1</td><td>2</td></tr>
<tr><td>1. Examination</td><td>60%</td><td>✓</td><td>✓</td></tr>
<tr><td>2. Continuous assessment</td><td>40%</td><td>✓</td><td>✓</td></tr>
<tr><td>Total</td><td>100 %</td><td colspan="2"></td></tr>
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The students will be assessed with two main components: examination and continuous assessment to consolidate their knowledge and techniques acquired in lectures and tutorials. Examination (60%) is in form of a three-hour, closed-book, end-of-subject written examination. Continuous assessment (40%) contains Assignment (Electrical) (10%), Assignment (Electronic) (10%), Test (Electrical) (10%), and Test (Electronic) (10%). They are appropriate in assessing intended learning outcomes 1 and 2.
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<tr><td>Student Study Effort Expected</td><td>
<table>
<tr><td>Class contact:</td><td></td></tr>
<tr><td>▪ Lecture/Tutorial</td><td>39 Hrs.</td></tr>
<tr><td>Other student study effort:</td><td></td></tr>
<tr><td>▪ Self-study</td><td>66 Hrs.</td></tr>
<tr><td>Total student study effort</td><td>105 Hrs.</td></tr>
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<tr><td>Reading List and References</td><td>Textbooks:
1. Giorgio Rizzoni and James Kearns, Principles and Applications of Electrical Engineering, 6th Edition, Boston: McGraw-Hill (2018).
2. Donald A. Neamen, Microelectronics: Circuit Analysis and Design, 4th Edition, Boston: McGraw-Hill (2010).
Reference books:
1. W. H. Hayt, J. E. Kemmerly, and S. M. Durbin, Engineering Circuit Analysis, 8th Edition, New York: McGraw-Hill (2012).
2. A. H. Robbins and W. C. Miller, Circuit Analysis: Theory and Practice, 5th Edition, Thomson Learning (2013).</td></tr>
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