A. **TITLE:** Electrical Circuits

B. **COURSE NUMBER:** ENGS 263

C. **CREDIT HOURS:** 3

D. **WRITING INTENSIVE COURSE:** No

E. **COURSE LENGTH:** 15 weeks

F. **SEMESTER(S) OFFERED:** Spring

G. **HOURS OF LECTURE, LABORATORY, RECITATION, TUTORIAL, ACTIVITY:**
   3 lecture hours per week

H. **CATALOG DESCRIPTION:** Electric circuit theory is introduced with emphasis on mathematical definitions of circuit elements. Network analysis techniques are presented within the framework of direct and alternating current theory. Transient forced and complete responses of circuits involving resistance, inductance, and capacitance are analyzed via differential and integral calculus. Circuit Design using Operational Amplifiers.

I. **PRE-REQUISITES/CO-REQUISITES:**
   Prerequisites: Calculus II (MATH 162), University Physics II (PHYS 132), or permission of instructor.

J. **GOALS (STUDENT LEARNING OUTCOMES):**
   By the end of this course, the student will be able to:

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<tr>
<th>Student Learning Outcomes</th>
<th>ABET</th>
<th>Institutional SLO</th>
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   | a. Understand the basic electric theory w/emphasis on mathematical definitions of circuit elements | a, e | 2. Crit. Thinking  
3. Prof. Competence                                                              |
   | b. Use different techniques to analyze electrical circuits                                 | a, e, k | 2. Crit. Thinking  
3. Prof. Competence                                                              |
   | c. Design electrical circuits using Operational Amplifier                                  | b, c, e, k | 1. Critical Thinking  
3. Prof. Competence                                                              |


L. **REFERENCES:** None

M. **EQUIPMENT:** None

N. **GRADING METHOD:** A - F
N. MEASUREMENT CRITERIA/METHODS:
   • Exams
   • Quizzes
   • Participation

P. DETAILED COURSE OUTLINE:

I. Basic Concepts
   A. System of Units
   B. Basic Quantities
   C. Independent Sources
      1. Voltage Sources
      2. Current Sources

II. Resistive Circuits
   A. Ohms Law
   B. Kirchhoff’s Laws
      1. Voltage Law
      2. Current Law
   C. Single-Loop Circuits
   D. Single-Node Circuits
   E. Series-Parallel Circuits
   F. Dependent Sources
   G. Circuits with Operational Amplifiers

III. Nodal and Loop Analysis
   A. Nodal Analysis
   B. Loop Analysis

IV. Circuit Analysis Theorems
   A. Linearity
   B. Source Transformation
   C. Thevenin’s and Norton’s Theorems
   D. Superposition

V. Capacitance and Inductance
   A. Capacitors
      1. Energy Storage
      2. Series Combinations
      3. Parallel Combinations
      4. Series-Parallel Combinations
   B. Inductors
      1. Energy Storage
      2. Series Combinations
      3. Parallel Combinations
4. Series-Parallel Combinations
C. Duality

VI. RC and RL Circuits

A. Source Free Circuits
   1. RC Circuits
   2. RL Circuits
B. Forcing Functions
   1. Constant Forcing Functions
   2. Pulse Response

VII. Sinusoidal Steady-State Analysis

A. Sinusoids
B. Sinusoidal and Complex Forcing Functions
C. Phasors
   1. Relationships for Circuit Elements
   2. Analysis Using Kirchhoff’s Laws
D. Impedance and Admittance

VIII. Steady-State Power Analysis

A. Instantaneous Power
B. Average Power
C. Effective or RMS Values
D. Complex Power
   1. Real Power
   2. Reactive Power
   3. Apparent Power
   4. Power Factor

Q. **LABORATORY OUTLINE:** None