# ENGR 230 – ENGINEERING CIRCUIT ANALYSIS | 3 CREDITS

## SYLLABUS

## CATALOG DESCRIPTION

Introductory engineering analysis of analog circuits. Topics include electrical component descriptions and equations (resistors, inductors, and capacitors), Kirchhoff's voltage and current laws, and calculus based formulation of network equations using time and frequency domain concepts.

Prerequisites:     MATH 189

Semester Offered:   Fall

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### Common Student Learning Outcomes

*Upon successful completion of San Juan College programs and degrees, the student will demonstrate competency in…*

BROAD AND SPECIALIZED LEARNING

Students will actively and independently acquire, apply, and adapt skills and knowledge with an awareness of global contexts.

CRITICAL THINKING

Students will think analytically and creatively to explore ideas, make connections, draw conclusions and solve problems.

CULTURAL AND CIVIC ENGAGEMENT

Students will act purposefully, reflectively, and ethically in diverse and complex environments.

EFFECTIVE COMMUNICATION

Students will exchange ideas and information with clarity in multiple contexts.

INFORMATION LITERACY

Students will be able to recognize when information is needed and have the ability to locate, evaluate, and use it effectively.

INTEGRATING TECHNOLOGIES

Students will demonstrate fluency in the application and use of technologies in multiple contexts.

*Student work from this class may be randomly selected and used anonymously for assessment of course, program, and/or institutional learning outcomes. For more information, please refer to the Dean of the appropriate School.*

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## Course Learning Outcomes

Upon successful completion of the course, the student will be able to…

1. Basic circuit and component definitions
2. Circuit analysis techniques
3. Transient analysis of circuits combining resistive, inductive, and capacitive components
4. Alternating current circuit analysis

# Specific Learning Outcomes

Upon successful completion of the course, the student will be able to…

1.1. Define concepts of electric charge, current, voltage, power, and energy
1.2. Describe constant and alternating voltage and current sources mathematically, and with respect to their qualitative effects on various circuits
1.3. Describe resistors, capacitors, and inductors mathematically, and with respect to their qualitative effects on various circuits
1.4. Draw accurate circuit diagrams from verbal descriptions and actual circuits
1.5. Recognize series and parallel combinations of components in circuit diagrams and actual circuits
1.6. Verbally describe the characteristics of an operational amplifier


2.1. State, verbally and mathematically, Ohm's and Kirchhoff's laws
2.2. Apply Ohm's and Kirchhoff's laws to simple circuits and solve for unknown voltage and/or currents
2.3. Simplify series and parallel combinations of sources, resistors, capacitors, and inductors
2.4. Divide voltage among resistors in series
2.5. Divide current among resistors in parallel
2.6. Use nodal analysis to write simultaneous equations for unknown voltages
2.7. Use mesh analysis to write simultaneous equations for unknown currents
2.8. Solve simultaneous equations using matrices and a scientific calculator
2.9. Apply superposition to circuits with multiple sources
2.10. Use Thevenin / Norton equivalent circuits to isolate and analyze particular resistive loads
2.11. Recognize the condition for maximum power transfer in Thevenin / Norton equivalent circuits
2.12. Identify and apply an appropriate analysis technique by examining a basic circuit diagram
2.13. Calculate voltage across, and current through, individual components in the circuits of 2.12


3.1. Derive the first order differential equations which describe voltage/current response in undriven RL and RC circuits
3.2. Describe the properties of an exponential response, including the concept of time constant
3.3. Solve for time dependent responses in undriven RL and RC circuits
3.4. Derive the first order differential equations which describe voltage/current response in driven RL and RC circuits
3.5. Describe the properties of both the natural and forced response solution
3.6. Solve for time dependent responses in driven RL and RC circuits
3.7. Describe how frequency filters can be made with simple RL and RC circuits
3.8. Derive the second order differential equations which describe voltage/current response in source-free parallel and series RLC circuits
3.9. Recognize the cause of the three different types of solutions: overdamped, critically damped, and underdamped
3.10. Visualize, graphically, the difference in response between the three solutions
3.11. Add the forced response to the source-free solution to determine the complete response of a driven RLC circuit


4.1. Mathematically describe sinusoidal sources
4.2. Describe why responses are phase-shifted in capacitors and inductors
4.3. Analyze simple circuits by applying complex forcing functions
4.4. Use the phasor concept to simplify R, L, and C response analysis
4.5. Define impedance and use it to analyze circuits containing R, L, and C components
4.6. Expand the use of the advanced circuit analysis techniques to sinusoidal, steady-state circuits
4.7. Use phasor diagrams to visualize responses within the circuit
4.8. Define instantaneous, average, and RMS power
4.9. Explain the consequences of apparent power and power factor