MOHAWK VALLEY COMMUNITY COLLEGE

UTICA AND ROME, NEW YORK

COURSE OUTLINE

Electronics of Unmanned Aerial Systems

ET112

1. CATALOG DESCRIPTION:

ET112 Electronics of Unmanned Aerial Systems

## C-3, P-3, Cr-3

This course provides the student with basic knowledge of electrical theory. Topics include electron theory, Ohm’s Law, series and parallel circuits, electrical energy and power relationships, electromagnetism, and DC & AC circuit theory as applied to unmanned aerial vehicles

II STUDENT OUTCOMES:

#### The student will:

1. Develop an essential understanding of theoretical DC & AC Electricity
2. Perform basic measurements with constructed electronic circuits
3. Perform calculations for both AC & DC Circuitry
4. Design and analyze circuits using flight controllers, BLDC motors, Electronic Speed Controllers and Voltage Regulators.
5. Calculate Electronic Requirements Required for a given Load and Endurance

DETAILED COURSE OUTLINE:

. Systems, Quantities, and Units (Chapter 1) (3 Periods)

A. Circuit Components and Electronic Instruments

B. Scientific Notation

C. Metric Prefixes

D. Metric Unit Conversions

Voltage, Current, and Resistance (Chapter 2) (3 Periods)

A. Atoms

B. Electrical Charge

C. Voltage

D. Current

E. Resistance

F. The Electric Circuit

G. Basic Circuit Measurements

Ohm’s Law, Energy, and Power (Chapter 3) (3 periods)

1. Ohm’s Law
2. Application of Ohm’s Law
3. Energy and Power
4. Power in an Electric Circuit
5. The Power Rating of Resistors
6. Energy Loss and Voltage Drop in Resistance
7. Power Supplies
8. sUAS Batteries

Series Circuits (Chapter 4) (3 periods)

1. Resistors in Series
2. Current in a Series Circuit
3. Total Series Resistance
4. Ohm’s Law in Series Circuits
5. Voltage Sources in Series
6. Kirchhoff’s Voltage Law

#### Voltage Dividers

1. Power in a Series Circuit
2. Circuit Ground
3. sUAS LIPO Battery Circuits

Parallel Circuits (Chapter 5) (3 Periods)

##### Resistors in Parallel

##### Voltage Drop in Parallel Circuits

##### Kirchhoff’s Current Law

##### Total Parallel Resistance

##### Ohm’s Law in Parallel Circuits

##### Current Dividers

##### Power in Parallel Circuits

Series-Parallel Circuits (Chapter 3) (9 periods)

A. Identifying Series-Parallel Relationships

B. Analysis of Series-Parallel Circuits

C. Voltage Dividers with Resistive Loads

D. Loading Effect of a Voltmeter

E. The Wheatstone Bridge

F. Circuits with More than One Voltage Source

G. Thevenin’s Theorem

Magnetism and Electromagnetism (Chapter 7) (3 periods)

A. The Magnetic Field

B. Electromagnetism

C. Electromagnetic Devices

D. Magnetic Hysteresis

E. Electromagnetic Induction

Test (1 period)

AC Current & Voltage (Chapter 8) (3 periods)

1. The Sinusoidal Waveform
2. Voltage & Current of A Sine Wave
3. AC Motors
4. 3 Phase BLDC Motors

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1. The Sinusoidal Waveform
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Capacitors (Chapter 9) (3 periods)

1. The Basic Capacitor
2. Types of Capacitors
3. Capacitor use in sUAS
4. Series & Parallel Capacitor Circuits

RC Circuits (Chapter 10) (3 periods)

1. The Sinusoidal Waveform
2. Voltage & Current of A Sine Wave
3. AC Motors
4. 3 Phase BLDC Motors in sUAS

Inductors(Chapter 11) (3 periods)

1. The Basic Inductor
2. Types of Inductors
3. Inductor Uses in sUAS

RL Circuits(Chapter 12) (3 periods)

1. Inductors in AC Circuits
2. Electronic Speed Controllers in sUAS
3. Power in RL Circuits

RLC Circuits(Chapter 13) (1 periods)

1. Series & Parallel Resonance
2. Filters
3. Gimbal Circuitry aboard sUAS

Transformers(Chapter 14) (1 periods)

1. Mutual Inductance
2. Step up and Step Down Transformers
3. Transformer Circuitry aboard sUAS

Reactive Circuits(Chapter 15) (1 periods)

1. Small Circuitry devices aboard sUAS
2. Camera Trigger Circuitry
3. Gimbal Adaptations
4. Autopilot types and Styles

Test 2

LABORATORY EXPERIMENTS:

Students should submit technical reports for the laboratory exercises. Appropriate graphs,

tables, and subsequent analysis are expected along with proper spelling and grammar.

1. Safety Procedures, Lab Introduction
2. DC wiring and Voltmeters
3. Simple series circuits
4. Parallel Circuits
5. Capacitors
6. Inductors
7. Voltage Regulators
8. Diode Circuits
9. Electronic Speed Controllers
10. Three phase BLDC motor circuits
11. Integrated Circuits
12. Timers
13. Autopilots
14. Putting a system UAS together
15. Telemetry