SOUTHEAST COMMUNITY COLLEGE
TRANSPORTATION DIVISION
JOHN DEERE CONSTRUCITON & FORESTRY EQUIPMENT TECH
COURSE SYLLABUS
December 12, 2022

I. CATALOG DESCRIPTION

Course Number: JDCE2320
Course Title John Deere C&F Advanced Electronic Systems & Engine Technology
Prerequisite(s): JDCE1135, JDCE1220, JDCE1901, JDCE2330

Catalog Description: This course places emphasis on electronic control systems used in John Deere construction equipment. Presenting the design and function of electronic system controls. A study of input sensors used to measure position, speed, temperature, pressure, air flow, proximity, light, fluid level, contamination and exhaust emissions. The function of electronic controllers, drivers and system outputs to actuators including pulse width modulation. Controller communication, LIN and CAN systems are discussed. Topics include electronic control systems, ignition systems, electronic diesel fuel injection systems, emission control strategies, and exhaust aftertreatment system technology. Use test meters to measure volts, amps, frequency and duty cycle for system diagnostics. Use Service Advisor as a scanning and diagnostic tool as well as machine OBD systems. An advanced look into using system functional schematics and electrical diagrams is included. Use tools and resources to complete the hands-on machine electronics and engine systems diagnostic lab activities. Safety while working with fuels, moving parts, extreme heat, and high pressure injection systems will be practiced.

Credit Hours: 6
Class Hours: 45
Lab Hours: 135
Total Contact Hours: 180

II. COURSE OBJECTIVES: *Course will:*

- **A.** Review electrical circuits and demonstrate how Ohm's law relates to controller sensor circuits and system diagnostics.
- **B.** Explain basic engine control systems related to electronic ignition and electronic diesel fuel injection systems.
- **C.** Explain the design and function of electronic control units.
- **D.** Explain how sensors function to provide input information to electronic control units and how ECU logic uses sensor inputs to calculate outputs to control actuators.
- **E.** Demonstrate how to diagnose controller, sensor and actuator circuits.
- **F.** Explain how electronic control units communicate over CAN systems.
- **G.** Demonstrate CAN system diagnostics.
- **H.** Explain the dangers of transient voltage and how damage to controllers can be prevented.
- **I.** Explain how controllers monitor circuits and produce diagnostic trouble codes.
- **J.** Demonstrate multiple ways to retrieve diagnostic trouble codes and how to interpret them for system diagnostics.
- **K.** Demonstrate electrical harness and connector repair techniques.

L. Provide the opportunity to make and use break-out test leads for diagnostics.
M. Explain pulse width modulation and demonstrate how to measure frequency and duty cycle for system diagnostics.
N. Demonstrate how to use circuit voltage readings to diagnose electronic circuit failures.
O. Explain system functional schematics, wiring diagrams, component location diagrams, symbols, component letter designation and circuit identification code.
P. Explain diesel fuel, and diesel engine emission regulations.
Q. Explain the design and function of electronically controlled diesel fuel injection pumps.
R. Explain the design and function of low-pressure common rail fuel systems and electronic unit injectors.
S. Explain the design and function of high-pressure common rail (HPCR) fuel systems.
T. Explain the design and function of variable geometry turbochargers, EGR systems and the purpose of cooled exhaust gas recirculation.
U. Explain the design and function of exhaust after treatment systems and system management strategies.
V. Demonstrate Using Service advisor readings, Interactive tests, machine OBD and test meters for diagnostics.
W. Provide the opportunity for hands on machine electronics and engine systems diagnostics.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES

A. STUDENT LEARNING OUTCOMES: *Student will be able to:*

1. Use knowledge of Ohm's law to understand and diagnose controller sensor circuits.
2. Understand basic engine control systems related to electronic ignition and electronic diesel fuel injection systems.
3. Understand the design and function of electronic control units.
4. Understand how sensors function to provide input information to electronic control units and how ECU logic uses sensor inputs to calculate outputs to control actuators.
5. Diagnose controller, sensor and actuator circuits.
6. Perform CAN system diagnostics.
7. Identify sources of transient voltage and how damage to controllers can be prevented.
8. Retrieve diagnostic trouble codes and know how to interpret them for system diagnostics.
9. Perform electrical harness and connector repairs.
10. Make and use break-out test leads for diagnostics.
11. Measure frequency and duty cycle for system diagnostics.
12. Use circuit voltage readings to diagnose electronic circuit failures.
13. Use system functional schematics, wiring diagrams, component location diagrams, symbols, component letter designation and circuit identification code for system diagnostics.
14. Understand diesel fuel, and diesel engine emission regulations.
15. Diagnose and repair engines equipped with electronically controlled diesel fuel injection pumps.
16. Diagnose and repair engines equipped with low pressure common rail fuel systems and electronic unit injectors.
17. Diagnose and repair engines equipped with high pressure common rail (HPCR) fuel systems.
18. Diagnose and repair engines equipped with variable geometry turbochargers, and exhaust gas recirculation systems.
19. Diagnose and repair exhaust after treatment systems.

20. Use Service advisor readings, Interactive tests, machine OBD and test meters for machine diagnostics.
21. Perform machine electronic control systems diagnostics, repairs and calibrations.

B. GENERAL EDUCATION LEARNING OUTCOME:

GELO 3: Critical Thinking & Problem Solving

1. Collect, identify, interpret and analyze data.
2. Synthesize information to arrive at reasoned solutions to problems.
3. Acquire and integrate knowledge and construct relationships across disciplines.

IV. CONTENT/TOPICAL OUTLINE

A. Electrical circuit review - Using Ohm's law
B. Ignition systems
C. Electronic ignition and diesel fuel injection systems - basic electronic engine control
D. Electronic control units, ECU logic, inputs, outputs, circuits, sensors and actuators
E. Electronic control unit communications LIN and CAN systems
F. Integrated circuit protection, and dangers of transient voltage sources
G. Diagnostic trouble codes
H. Electrical harness and connector repair. Making and using break-out test leads. (Lab activity)
I. Using test meters for diagnostics – volts, amps, ohms, frequency and duty cycle. (PWM)
J. Diagnosing circuits, sensors and actuators using voltage readings. Source, potential, available, and drop.
K. System functional schematics, wiring diagrams, component location diagrams, symbols, component letter designation and circuit identification code
L. Diesel engine emission regulations and the TIER system
M. Modern fuels
N. Diesel fuel systems – electronically controlled injection pumps
O. Diesel fuel systems – low pressure common rail fuel systems, electronic unit injectors
P. Diesel fuel systems – high pressure common rail fuel systems (HPCR)
Q. Variable geometry turbo charging (VGT) and cooled exhaust gas recirculation (EGR)
R. Exhaust after treatment systems and system management strategies
S. Using Service advisor for diagnostics, interactive tests, machine OBD and test meters
T. Machine electronics and engine systems diagnostic lab activities

V. INSTRUCTIONAL MATERIALS

Required text(s): Service Advisor (made available in the classroom)
FOS Engines
FOS Electrical/Electronic Systems

Other material(s): Required tool set, safety glasses (regulation Z87), leather shoes, John Deere uniform, colored pencils, notebook, writing instruments, calculator

VI. METHODS OF PRESENTATION/INSTRUCTION

A. Methods of presentation typically include a combination of the following:

1. Small and large group discussion
2. Video presentations
3. Demonstrations
4. Project boards
5. Flip charts
6. Handouts

7. Observations
8. Field trips

VII. METHODS OF EVALUATION

A. Methods of evaluation typically include a combination of the following:

1. Notebook (if required)
2. Quizzes
3. Tests
4. Lab Grades
5. Reflection assignments
6. Lab/classroom presentations

Grading will follow the SCC Standard Grade Scale Policy. See **Course Information Document** for specific details on how the course grades are calculated.

VIII. SPECIFIC COURSE REQUIREMENTS:

A. Students must complete all tests, projects, assignments, and notebook (if required).

B. Students must earn a final grade of 70% (2.0) or higher.

C. Program safety rules will be followed. See the **Course Information Document** for any additional safety rules established by the instructor.

D. Safety belts will be worn at all times, on or in any motorized vehicle, if equipped.

E. Attendance and participation. See **Course Information Document** for attendance and participation policy.