SYLLABUS

DATE OF LAST REVIEW: 02/11/2013

CIP CODE: 47.0604

SEMESTER: Departmental Syllabus

COURSE TITLE: Hybrid and Electric Vehicles

COURSE NUMBER: AUTT0296

CREDIT HOURS: 3

INSTRUCTOR: Departmental Syllabus

OFFICE LOCATION: Departmental Syllabus

OFFICE HOURS: Departmental Syllabus

TELEPHONE: Departmental Syllabus

EMAIL: KCKCC issued email accounts are the official means for electronically communicating with our students.

PREREQUISITE(S): AUTT0102, AUTT0262 or approval of the instructor.

REQUIRED TEXT AND MATERIALS:
Please see bookstore for current textbook(s) and other required material.

COURSE DESCRIPTION:
The student will learn the theory and operation of hybrid drive systems in the automobile. The content will cover batteries, charging, high voltage safety, transmission, inverter/converter operation, cooling systems, diagnosis and repair of these advanced and unique automobiles. The course will emphasize the importance of safety due to the deadly nature of the high voltage environment. Students are required to purchase their own high voltage class 0 gloves to participate in live lab experiences.

METHOD OF INSTRUCTION:
A variety of instructional methods may be used depending on content area. These include but are not limited to: lecture, multimedia, cooperative/collaborative learning, labs and demonstrations, projects and presentations, speeches, debates, and panels,
conferencing, performances, and learning experiences outside the classroom. Methodology will be selected to best meet student needs.

COURSE OUTLINE:
All students must comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

I. Introduction to Hybrid and Electric Vehicles
   A. Series design
   B. Parallel design
   C. HEV technologies
II. High Voltage Electrical Safety
   A. Electric shock
   B. Tool and equipment usage and high voltage systems
   C. Electrical isolation
   D. Multimeters
   E. CAT III
III. High Voltage Vehicle Safety Systems
   A. Hybrid high voltage safety systems
   B. Serial interlock loop
   C. Service disconnect switch systems
   D. Testing for isolation faults
IV. AC Motor Operation
   A. Electric motor theory
   B. Electric vehicle system components
   C. The rotor and stator
V. Power Inverter and Converter Systems
   A. Power inverter operation
   B. The hybrid and electric power systems
   C. Basic motor controls
   D. Regenerative braking
   E. DC-DC converters
   F. Power generation
VI. Basic Electric Motor Sensing Systems
   A. Motor speed sensing
   B. Resolver
   C. Motor load / current sensing
   D. Throttle / brake pedal position sensing
VII. Transmission/Transaxles and Cooling Systems
   A. Electric& planetary gear operation
   B. Gear ratio blending between EM and ICE
   C. Cooling systems
VIII. Energy Management Operation
A. High voltage fuse
B. Current sensing
C. Battery contactors
D. Battery cooling and temperature sensing
E. Battery pack controller

IX. Nickel Metal Hydride Batteries
   A. Charge and discharge electrical characteristics
   B. NiMH capacity
   C. Advantages
   D. Disadvantages

X. Other Systems
   A. Hybrid jump starting
   B. Electro-hydraulic power steering system
   C. Vehicle braking system
   D. Driver information center
   E. Electric compressors

EXPECTED LEARNER OUTCOMES:
A. The student will be able to describe hybrid and electric vehicle operation
B. The student will be able to describe in detail high voltage electrical safety
C. The student will be able to explain high voltage vehicle safety systems
D. The student will be able to summarize A/C electric motor operation
E. The student will be able to describe power inverter and converter operation
F. The student will be able to explain basic electric propulsion sensing systems
G. The student will be able to review transaxles, gears
H. The student will be able to explain energy management operation
I. The student will be able to summarize nickel metal hydride technology
J. The student will be able to review other systems

COURSE COMPETENCIES:
The student will be able to describe hybrid and electric vehicle operation
1. Explain series, parallel and series parallel hybrid drives
2. Explain power flow through parallel, series and series parallel drives
   The student will be able to describe in detail high voltage electrical safety
3. Define high voltage and explain the implications of human interaction
4. Explain the purpose of personal protection equipment and what they do
5. Demonstrate how to wear high voltage personal protection equipment
6. Explain when and where personal protection equipment will be worn
   The student will be able to explain high voltage vehicle safety systems
7. Demonstrate how to disable high voltage safety systems on hybrid vehicles
8. Demonstrate location of isolation faults in high voltage circuits
   The student will be able to summarize A/C motor operation
9. Explain how an electric motor works
10. Explain how a brushless motor works
11. Explain rotor and stator interaction
   The student will be able to describe power inverter and converter operation
12. Review the operation of the power inverter
13. Explain DC/DC converter operation
14. Describe regenerative braking

   The student will be able to explain basic electric propulsion sensing systems

15. Describe motor speed sensing
16. Explain how motor load and electrical current sensing takes place
17. Describe throttle //pedal position sensing

   The student will be able to review transaxles, gears, and cooling systems

18. Explain planetary gear sets and their relationships
19. Explain gear ratio blending between the drive motors and the ICE
20. Describe cooling systems for the power inverter and how to service them

   The student will be able to explain energy management operation

21. Explain the basic operation of battery contactors
22. Describe basic operation of the HV battery cooling system for different models
23. Explain the basic operation of the HV battery controller
24. Describe what happens in a low charge condition to the HV battery

   The student will be able to summarize nickel metal hydride technology

25. Describe the advantages and disadvantages of the NiMH battery
26. Describe the chemical changes that occur during charging and discharging

   The student will be able to review other systems

27. Describe how brakes differ from non hybrid vehicles to hybrid vehicles
28. Explain battery service mode
29. Describe how electric compressors work
30. Explain vehicle jump starting

ASSESSMENT OF LEARNER OUTCOMES:
Assessment methods may include, but are not limited to, the following: Homework, Assignments, Quizzes, Class Participation, Chapter Tests, and Final Exam. The grading scale and the process for calculating the course grades are to be determined by the individual instructors. This information will be included in each instructor’s syllabus.

SPECIAL NOTES:
This syllabus is subject to change at the discretion of the instructor. Material included is intended to provide an outline of the course and rules that the instructor will adhere to in evaluating the student’s progress. However, this syllabus is not intended to be a legal contract. Questions regarding the syllabus are welcome any time.

Kansas City Kansas Community College is committed to an appreciation of diversity with respect for the differences among the diverse groups comprising our students, faculty, and staff that is free of bigotry and discrimination. Kansas City Kansas Community College is committed to providing a multicultural education and environment that reflects and respects diversity and that seeks to increase understanding.

Kansas City Kansas Community College offers equal educational opportunity to all students as well as serving as an equal opportunity employer for all personnel. Various
laws, including Title IX of the Educational Amendments of 1972, require the college’s policy on non-discrimination be administered without regard to race, color, age, sex, religion, national origin, physical handicap, or veteran status and that such policy be made known.

Kansas City Kansas Community College complies with the Americans with Disabilities Act. If you need accommodations due to a documented disability, please contact the Director of the Academic Resource Center in Room 3354 or call (913) 288-7670 V/TDD.