SYLLABUS

DATE OF LAST REVIEW : 02/11/2013
CIP CODE: 47.0614
SEMESTER: Departmental Syllabus
COURSE TITLE: Basic Hybrid/ Electric Vehicles
COURSE NUMBER: AHEV0203
CREDIT HOURS: 3
INSTRUCTOR: Departmental Syllabus
OFFICE LOCATION: Departmental Syllabus
OFFICE HOURS: Departmental Syllabus
TELEPHONE: Departmental Syllabus
EMAIL : Departmental Syllabus
KCKCC-issued email accounts are the official means for electronically communicating with our students.

PREREQUISITE(S): AUTT0262, AUTT0182 or approval by the instructor

REQUIRED TEXT AND MATERIALS: Please check with the KCKCC bookstore, http://www.kckccbookstore.com for the required text for your particular class.

COURSE DESCRIPTION:
The student will learn basic theory and operation of hybrid drive systems in the automobile. The content will cover basic theory of batteries, charging, transmission, inverter/converter operation, cooling systems, diagnosis and repair of these advanced and unique automobiles. The course will strongly 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. For every task in Basic Hybrid Electric Vehicles, the following safety requirement must be strictly enforced: 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.

**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. The student will be able to explain series, parallel and series parallel hybrid drives
2. The student will be able to explain power flow through parallel, series and series parallel drives

The student will be able to describe in detail high voltage electrical safety
3. The student will be able to define high voltage and explain the implications of human interaction
4. The student will be able to explain the purpose of personal protection equipment and what they do
5. The student will be able to demonstrate how to wear high voltage personal protection equipment
6. The student will be able to explain when and where personal protection equipment will be worn

_The student will be able to explain high voltage vehicle safety systems_
7. The student will be able to demonstrate how to disable high voltage safety systems on hybrid vehicles
8. The student will be able to demonstrate location of isolation faults in high voltage circuits

_The student will be able to summarize A/C motor operation_
9. The student will be able to explain how an electric motor works
10. The student will be able to explain how a brushless motor works
11. The student will be able to explain rotor and stator interaction

_The student will be able to describe power inverter and converter operation_
12. The student will be able to review the operation of the power inverter
13. The student will be able to explain DC/DC converter operation
14. The student will be able to describe regenerative braking

_The student will be able to explain basic electric propulsion sensing systems_
15. The student will be able to describe motor speed sensing
16. The student will be able to explain how motor load and electrical current sensing takes place
17. The student will be able to describe throttle //pedal position sensing

_The student will be able to review transaxles, gears, and cooling systems_
18. The student will be able to explain planetary gear sets and their relationships
19. The student will be able to explain gear ratio blending between the drive motors and the ICE
20. The student will be able to describe cooling systems for the power inverter and how to service them

_The student will be able to explain energy management operation_
21. The student will be able to explain the basic operation of battery contactors
22. The student will be able to describe basic operation of the HV battery cooling system for different models
23. The student will be able to explain the basic operation of the HV battery controller
24. The student will be able to describe what happens in a low charge condition to the HV battery

_The student will be able to summarize nickel metal hydride technology_
25. The student will be able to describe the advantages and disadvantages of the NiMH battery
26. The student will be able to describe the chemical changes that occur during charging and discharging

*The student will be able to review other systems*

27. The student will be able to describe how brakes differ from non hybrid vehicles to hybrid vehicles
28. The student will be able to explain battery service mode
29. The student will be able to describe how electric compressors work
30. The student will be able to explain vehicle jump starting

**ASSESSMENT OF LEARNER OUTCOMES:**
Student progress is evaluated by means that include, but are not limited to, exams, written assignments, and class participation.

**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 Rm. 3354 or call at: 288-7670.