DATE OF LAST REVIEW : 02/11/2013
CIP CODE: 47.0604
SEMESTER: Departmental Syllabus
COURSE TITLE: Advanced Engine Performance
COURSE NUMBER: AUTT0284
CREDIT HOURS: 2
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, AUTT0282 or approval by instructor.

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

COURSE DESCRIPTION:
Theory and operation of electronic engine controls and includes: electronic fuel injection, electronic ignitions, on-board diagnostics and current emission systems. Laboratory practice includes proper set up and use of digital storage oscilloscopes, scan tools, engine analyzer, four and five-gas emission analyzers systems

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. Engine inspection
   1. Engine theory
   2. Firing order
   3. Camshaft alignment
   4. Mechanical engine testing

II. Scan tools diagnosis
   A. Modes
   B. Freeze frame
   C. Data stream analysis
   D. Research diagnostic trouble codes

III. Exhaust gas analysis
   A. Pre and post cat performance
   B. 4 gas
   C. Excessive emissions on the environment
   D. Forcing rich and lean

IV. Charging system testing
   A. Charging system faults effecting engine performance
   B. Alternator output
   C. Presence of A/C
   D. Ground and power tests to PCM and engine grounds

V. Ignition system using the oscilloscope
   A. Primary ignition patterns on the oscilloscope
   B. Secondary ignition patterns on the oscilloscope
   C. Patterns for sensors on typical engine
   D. Patterns for actuators

VI. Diagnosis of performance problems from spark plug readings
   A. High and low voltage readings mean
   B. Effects of high compression on resistance
   C. Effects of rich mixtures on resistance
   D. Effects of spark plug design

VII. Engine compression testing
   A. Cylinder compression tests
   B. Cylinder leakage testing
   C. Engine running compression testing
   D. Compression transducer testing

VIII. Engine vacuum testing
   A. Manifold vacuum theory
   B. Normal readings
   C. Abnormal readings and their meanings
   D. Electronic vacuum transducer readings
   E. Backpressure testing with a vacuum gauge
IX. Current ramping ignition, fuel injection and fuel pumps  
   A. Set-up of a low amp current probe to scope  
   B. Reading current waveforms for sensors  
   C. Reading current waveforms for actuators  
   D. Wave forms for fuel pump diagnostics  
X. Discuss OBD-I, OBD-II and CAN systems  
   A. Why OBD-II was developed  
   B. Advantages of OBD-II  
   C. Global OBD-II and Enhanced OBD-II  
   D. Operating scan tools  
   E. CAN  
XI. Major emission controls  
   A. Functions of emission control devices  
   B. Diagnostics of emission control devices  
   C. Pulse width modulation  
   D. Emission component failures  
XII. Testing sensors, ECM, and actuators with DVOM and DSO.  
   A. Simulation of common sensor signals  
   B. Forced conditions and monitor results on datastream  
   C. Measuring sensor voltage, resistance, frequency and pulse width with a DVOM  
   D. Computer substituted signals  

EXPECTED LEARNER OUTCOMES:  
A. Basic engine inspection.  
B. Trouble-code retrieval using scan tools or on-board means.  
C. Four-gas and five-gas analysis  
D. Check charging system with VAT-40s, AVT’s and Electronic tester.  
E. Inspection and diagnosis of ignition system using the Engine Analyzer’s Oscilloscope.  
F. Proper diagnosis of engine performance problems from spark plug readings.  
G. Engine compression testing.  
H. Engine vacuum testing.  
I. Set up the DSO for current ramping ignition, fuel injection and fuel pumps.  
J. Discuss OBD-I, OBD-II, CAN, systems.  
K. Identification and testing of major emission control systems.  
L. Dynamic testing of sensors, ECM, and actuators with DVOM and DSO.

COURSE COMPETENCIES:  
*Student will be able to perform basic engine inspection.*  
1. Explain engine theory  
2. Describe firing order  
3. Explain camshaft alignment  
4. Demonstrate mechanical engine testing
Student will be able to trouble-code retrieval using scan tools or on-board means.
5. Explain modes
6. Explain freeze frame
7. Demonstrate data stream analysis
8. Describe how to research diagnostic trouble codes

Student will be able to perform four-gas and five-gas analysis
9. Explain pre and post cat performance
10. Demonstrate how to measure 4 gas
11. Describe the effects of excessive emissions on the environment
12. Force the car rich and lean and explain its usefulness

Student will be able to check charging system with VAT-40s, AVT’s and Electronic tester.
13. Explain charging system faults effects on engine performance
14. Check alternator output
15. Check for presence of A/C
16. Demonstrate ground and power tests to PCM and engine grounds

Student will be able to perform inspection and diagnosis of ignition system using the Engine Analyzer’s Oscilloscope.
17. Describe primary ignition patterns on the oscilloscope
18. Describe secondary ignition patterns on the oscilloscope
19. Demonstrate patterns for sensors on typical engine
20. Demonstrate patterns for actuators

Student will be able to perform proper diagnosis of engine performance problems from spark plug readings.
21. Explain what high and low voltage readings mean
22. Explain effects of high compression on resistance
23. Explain effects of rich mixtures on resistance
24. Demonstrate effects of spark plug design

Student will be able to perform engine compression testing.
25. Demonstrate cylinder compression tests
26. Demonstrate cylinder leakage testing
27. Demonstrate engine running compression testing
28. Explain compression transducer testing

Student will be able to perform engine vacuum testing.
29. Explain manifold vacuum theory
30. Explain normal readings
31. Explain abnormal readings and their meanings
32. Explain electronic vacuum transducer readings
33. Demonstrate backpressure testing with a vacuum gauge
Student will be able to set up the DSO for current ramping ignition, fuel injection and fuel pumps.
34. Demonstrate proper set up of a low amp current probe to scope
35. Read current waveforms for sensors
36. Read current waveforms for actuators
37. Identify wave forms for fuel pump diagnostics

Student will be able to discuss OBD-I, OBD-II, CAN, systems.
38. Explain why OBD-II was developed
39. Explain the advantages of OBD-II
40. Explain global OBD-II and Enhanced OBD-II
41. Demonstrate ability to operate 5 or more scan tools
42. Describe what CAN is and its usefulness

Student will be able to perform identification and testing of major emission control systems.
43. Describe functions of emission control devices
44. Demonstrate diagnostics of emission control devices
45. Explain pulse width modulation
46. Explain results of emission component failures

Student will be able to perform dynamic testing of sensors, ECM, and actuators with DVOM and DSO.
47. Demonstrate simulation of common sensor signals
48. Demonstrate forced conditions and monitor results on datastream
49. Measure sensor voltage, resistance, frequency and pulse width with a DVOM
50. Explain computer substituted signals and why they occur

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.