SYLLABUS

DATE OF LAST REVIEW: 02/11/2013
CIP CODE: 47.0604
SEMESTER: Departmental Syllabus
COURSE TITLE: Engine Repair
COURSE NUMBER: AUTT0212
CREDIT HOURS: 5
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): AUTT0101, AUTT0102 or approval of instructor

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

COURSE DESCRIPTION:
This course contains competencies that can be used in their entirety within a single course or as needed for courses designed by a Kansas institution as Institutional Flexible Credit. Through a variety of learning and assessment activities students can: explore the theory and operation of internal combustion engine; demonstrate the ability to remove an automotive engine; demonstrate the ability to install an automotive engine; demonstrate the basic ability to inspect and repair cylinder head, valve trains and timing defects; demonstrate the ability to disassemble short block; demonstrate the ability to inspect short block; demonstrate the ability to repair short block; demonstrate the ability to reassemble short block; demonstrate the basic ability to inspect and repair engine lubrication; demonstrate the basic ability to inspect and repair engine cooling systems; inspect a cylinder head and valve train; repair a cylinder head and valve train; perform
advanced level engine diagnosis.

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.

Engine Service and Repair
I. Explore the theory and operation of internal combustion engine
II. Demonstrate the ability to remove an automotive engine
   A. Complete work order
      1. Work orders
      2. Vehicle identification
      3. Customer interview
      4. Service history
      5. Researching vehicle and service information
      6. Technical service bulletins
      7. Locating vehicle and major component identification numbers
   B. Inspect engine for leaks
      1. Fuel
      2. Oil
      3. Coolant
      4. Other leaks
   C. Diagnosis of engine noises and vibrations
   D. Cylinder cranking and running compression tests
   E. Engine covers
      1. Gaskets
      2. Seals
      3. Sealers
   F. Common fastener
      1. Thread repair
      2. Broken bolt repair
      3. Restore internal and external threads
      4. Repair threads with insert
   G. Engine mounts
III. Automotive engine installation
   A. Engine removal and installation
   B. Component organization and restoration after engine replacement
   C. OBDII component connections

IV. Cylinder head inspection and repair
   A. Valve trains
   B. Timing defects
   C. Removal and installation
   D. Inspection
   E. Torque methods
   F. Crack inspection and repair
   G. Warpage and repair
   H. Surface finish
   I. Valves
      1. Valve stem seals
      2. Retainers
      3. Locks/keepers
      4. Valve guides
      5. Valve seats
      6. Valve spring assembled height
      7. Valve stem height
   J. Valve spring
      1. Height
      2. Squareness
      3. Rotators
      4. Tension
   K. Pushrods
   L. Rocker arms
      1. Pivots
      2. Shafts
   M. Valve lifters
   N. Valve adjustment
   O. Camshaft
   P. Engine timing
      1. Belts
      2. Chains
      3. Tensioners
      4. Run-out
      5. Lobe wear
      6. Alignment
   Q. Variable Valve Timing

V. Disassembly of the short block
   A. Engine disassembly
   B. Engine Cleaning
   C. Preparation for cleaning
   D. Inspection
1. Cracks
2. Passages
3. Core and galley plugs
4. Warpage

E. Cylinder walls/sleeves
   1. Inspect and measure cylinder walls/sleeves
   2. Ridges
   3. Deglazing
   4. Cylinder wall finish

F. Camshaft
   1. Cam bearings
   2. Out-of-round
   3. Alignment

G. Crankshaft
   1. Straightness
   2. Journal damage
   3. Keyway damage
   4. Thrust flange
   5. Surface condition
   6. Visual surface cracks
   7. Oil passage
   8. End play
   9. Position sensor
   10. Inspect main and connecting rod bearings for damage and wear

H. Piston
   1. Skirts
   2. Lands
   3. Piston pin
   4. Piston to bore clearance
   5. Rings

I. Auxiliary/balance shafts
J. Vibration dampener/harmonic balancer

VI. Inspecting the short block
A. Cleaning techniques
B. Measuring cylinders
C. Measuring pistons
D. Measuring crankshaft
E. Measuring camshaft
F. Measuring warpage
G. Measuring bore

VII. Short block repair
A. Piston
   1. Undersize pistons
   2. Performance pistons
B. Bore
C. Sleeve
D. Surface finish to ring type
E. Torque to yield bolts
F. Crack repair
G. Deck finishing
H. Undersize/oversize crankshaft
I. Line boring
J. Bearing dimensions
K. Harmonic balancer sleeve

VIII. Short block reassembly
A. Sealers
B. Gaskets
C. Fasteners
D. Torque procedures
E. Pre-lubrication

IX. Engine lubrication
A. Oil pressure tests
B. Oil pump
   1. Gears or rotors
   2. Housing
   3. Pressure relief devices
   4. Pump drive
C. Oil coolers
D. Oil temperature and pressure switches and sensors
E. Oil and filter changes

X. Engine cooling systems
A. Cooling system pressure tests
B. Coolant condition
C. Radiator
D. Pressure cap
E. Coolant recovery tank
F. Hoses
G. Drive Belts
H. Tensioners
I. Heater system hoses
J. Thermostat and gasket/seal.
K. Drain and recover coolant
L. Flushing
M. Bleed air
N. Water pump
O. Radiator fans(s) (electrical or mechanical)
P. Fan clutch, fan shroud, and air dams
Q. Combustible gasses testing

XI. Inspection of cylinder head and valve train
A. Remove
B. Cleaning
C. Inspection
D. Measurements
   1. Spring
   2. Valve
   3. Warpage
   4. Cracks
   5. Sealing
   6. Valve guide clearance
   7. Stem height
   8. Valve spring installed height
   9. Pushrod straightness
  10. Rocker arms
  11. Rocker shafts
  12. Oil passages
  13. Lifters
  14. Drive sprockets
  15. Camshaft
  16. Lobe wear
  17. Out of round
  18. Valve lash
  19. Thread repairs

XII. Cylinder head valve train
A. Springs
   1. Squareness
   2. Free height
B. Valve stem
   1. Seals
   2. Retainers
   3. Locks/keepers
C. Valve guides
D. Stem clearance
E. Valve Seats
F. Check valve spring assembled height and valve stem height
G. Rocker arms
H. Pivots
I. Oil passages
J. Lifters

XIII. Advanced level engine diagnosis
A. Diagnosing engine noises and vibrations
B. Electrical testing of fans
C. Mechanical fan clutches
D. Identify hybrid vehicle internal combustion engine service precautions
E. Oil consumption
F. Coolant consumption
G. Exhaust color and odor diagnostics
H. Engine vacuum tests
I. Cylinder power balance tests
J. Cylinder cranking and running compression tests
K. Cylinder leakage tests
L. Active tests of actuators using a scan tools

EXPECTED LEARNER OUTCOMES:
A. The student will be able to summarize the theory and operation of internal combustion engine
B. The student will be able to explain how to remove an automotive engine
C. The student will be able to explain how to install an automotive engine
D. The student will be able to describe how to inspect and repair cylinder head, valve trains and timing defects
E. The student will be able to summarize how to disassemble a short block
F. The student will be able to explain how to inspect a short block
G. The student will be able to explain how to repair a short block
H. The student will be able to review how to reassemble a short block
I. The student will be able to describe how to inspect and repair engine
   Lubrication systems
J. The student will be able to explain how to inspect and repair engine
   cooling systems
K. The student will be able to review how to inspect a cylinder head and valve train
L. The student will be able to summarize how to repair a cylinder head and valve train
M. The student will be able to explain how to diagnose engine performance

COURSE COMPETENCIES:

The student will be able to summarize the theory and operation of internal combustion engine
1. In the classroom setting, using instructor-provided evaluation criteria
The student will be able to explain how to remove an automotive engine
2. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction
3. Identify and interpret engine concern; determine necessary action
4. Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins
5. Locate and interpret vehicle and major component identification numbers
6. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action
7. Diagnose engine noises and vibrations; determine necessary action
8. Perform cylinder cranking and running compression tests; determine necessary action
9. Install engine covers using gaskets, seals and sealers as required
10. Perform common fastener and thread repair, to include: remove broken bolt, restore internal and external threads, and repair internal threads with thread insert
11. Inspect, remove and replace engine mounts
The student will be able to explain how to install an automotive engine

12. Remove and reinstall engine in OBDII or newer vehicle; reconnect all attaching components and restore the vehicle to running condition
13. Install engine covers using gaskets, seals and sealers as required
14. Inspect, remove and replace engine mounts
15. Remove cylinder heads; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer’s specifications and procedures
16. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition
17. Inspect valve springs for squareness and free height comparison; determine necessary action
18. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action
19. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action
20. Inspect valves and valve seats; determine necessary action
21. Check valve spring assembled height and valve stem height; determine necessary action
22. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action
23. Inspect valve lifters; determine necessary action
24. Adjust valves (mechanical or hydraulic lifters)
25. Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and variable valve timing components)
26. Inspect and/or measure camshaft for runout, journal wear and lobe wear
27. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action
28. Establish camshaft position sensor indexing
29. Adjust valves on engines with mechanical or hydraulic lifters
30. Remove and replace timing belt; verify correct camshaft timing
31. Perform engine oil and filter change
32. Disassemble engine block; clean and prepare components for inspection and reassembly
33. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action
34. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action
35. Deglaze and clean cylinder walls
36. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action
37. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action
38. Inspect main and connecting rod bearings for damage and wear; determine necessary action
39. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action
40. Inspect and measure piston skirts and ring lands; determine necessary action
41. Remove and replace piston pin
42. Determine piston-to-bore clearance
43. Inspect, measure, and install piston rings
44. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time
45. Remove, inspect or replace crankshaft vibration damper (harmonic balancer)
46. Assemble engine block
47. Disassemble engine block; clean and prepare components for inspection and reassembly
48. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action
49. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action
50. Deglaze and clean cylinder walls
51. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action
52. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action
53. Inspect main and connecting rod bearings for damage and wear; determine necessary action
54. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action
55. Inspect and measure piston skirts and ring lands; determine necessary action
56. Remove and replace piston pin
57. Determine piston-to-bore clearance
58. Inspect, measure, and install piston rings
59. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time
60. Remove, inspect or replace crankshaft vibration damper (harmonic balancer)
61. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action

The student will be able to explain how to inspect a short block

The student will be able to explain how to repair a short block
62. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action
63. Deglaze and clean cylinder walls
64. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action
65. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action
66. Inspect main and connecting rod bearings for damage and wear; determine necessary action
67. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action
68. Inspect and measure piston skirts and ring lands; determine necessary action
69. Remove and replace piston pin
70. Determine piston-to-bore clearance
71. Inspect, measure, and install piston rings
72. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time
73. Remove, inspect or replace crankshaft vibration damper (harmonic balancer)
The student will be able to review how to reassemble a short block
74. Disassemble engine block; clean and prepare components for inspection and reassembly
75. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action
76. Inspect and measure cylinder walls/sleeves for damage, wear, and ridges; determine necessary action
77. Deglaze and clean cylinder walls
78. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action
79. Inspect crankshaft for straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure end play and journal wear; check crankshaft position sensor reluctor ring (where applicable); determine necessary action
80. Inspect main and connecting rod bearings for damage and wear; determine necessary action
81. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; determine necessary action
82. Inspect and measure piston skirts and ring lands; determine necessary action
83. Remove and replace piston pin
84. Determine piston-to-bore clearance
85. Inspect, measure, and install piston rings
86. Inspect auxiliary shaft(s) (balance, intermediate, idler, counterbalance or silencer); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time
87. Remove, inspect or replace crankshaft vibration damper (harmonic balancer)
88. Assemble engine block

The student will be able to describe how to inspect and repair engine
Lubrication systems

89. Perform oil pressure tests; determine necessary action
90. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive;
perform necessary action
91. Inspect auxiliary coolers; determine necessary action
92. Inspect, test, and replace oil temperature and pressure switches and sensors
93. Perform oil and filter change
94. Identify causes of engine overheating

The student will be able to explain how to inspect and repair engine cooling
systems

95. Perform cooling system pressure tests; check coolant condition; inspect and test
radiator, pressure cap, coolant recovery tank, and hoses; determine necessary
action
96. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley
and belt alignment
97. Inspect and replace engine cooling and heater system hoses
98. Inspect, test, and replace thermostat and gasket/seal
99. Test coolant; drain and recover coolant; flush and refill cooling system with
recommended coolant; bleed air as required
100. Inspect, remove and replace water pump
101. Remove and replace radiator
102. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and
air dams
103. Identify causes of engine overheating
104. Remove and replace thermostat and gasket/seal

The student will be able to review how to inspect a cylinder head and valve
train

105. Remove cylinder heads; inspect gasket condition; install cylinder head and
gasket; tighten according to manufacturer’s specifications and procedures
106. Clean and visually inspect a cylinder head for cracks; check gasket surface areas
for warpage and surface finish; check passage condition
107. Inspect valve springs for squareness and free height comparison; determine
necessary action
108. Replace valve stem seals on an assembled engine; inspect valve spring retainers,
locks/keepers, and valve lock/keeper grooves; determine necessary action
109. Inspect valve guides for wear; check valve stem-to-guide clearance; determine
necessary action
110. Inspect valves and valve seats; determine necessary action
111. Check valve spring assembled height and valve stem height; determine necessary
action
112. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending,
cracks, looseness, and blocked oil passages (orifices); determine necessary action
113. Inspect valve lifters; determine necessary action
114. Adjust valves (mechanical or hydraulic lifters)

115. Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and variable valve timing components)

116. Inspect and/or measure camshaft for runout, journal wear and lobe wear

117. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action

118. Establish camshaft position sensor indexing

119. Adjust valves on engines with mechanical or hydraulic lifters

120. Remove and replace timing belt; verify correct camshaft timing

121. Remove and replace thermostat and gasket/seal

122. Perform common fastener and thread repairs to include: remove broken bolt, restore internal and external threads, and repair internal threads with a threaded insert

The student will be able to summarize how to repair a cylinder head and valve train

123. Remove cylinder heads; inspect gasket condition; install cylinder head and gasket; tighten according to manufacturer’s specifications and procedures

124. Clean and visually inspect a cylinder head for cracks; check gasket surface areas for warpage and surface finish; check passage condition

125. Inspect valve springs for squareness and free height comparison; determine necessary action

126. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks/keepers, and valve lock/keeper grooves; determine necessary action

127. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action

128. Inspect valves and valve seats; determine necessary action

129. Check valve spring assembled height and valve stem height; determine necessary action

130. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action

131. Inspect valve lifters; determine necessary action

132. Adjust valves (mechanical or hydraulic lifters)

133. Inspect and replace camshaft and drive belt/chain (includes checking drive gear wear and backlash, end play, sprocket and chain wear, overhead cam drive sprocket(s), drive belt(s), belt tension, tensioners, camshaft reluctor ring/tone-wheel, and variable valve timing components)

134. Inspect and/or measure camshaft for runout, journal wear and lobe wear

135. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action

136. Establish camshaft position sensor indexing

137. Adjust valves on engines with mechanical or hydraulic lifters

138. Remove and replace timing belt; verify correct camshaft timing
139. Remove and replace thermostat and gasket/seal
140. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air
dams, and fan control devices; perform necessary action
141. Perform common fastener and thread repairs to include: remove broken bolt,
restore internal and external threads, and repair internal threads with a threaded
insert
142. Perform engine oil and filter change
143. Identify hybrid vehicle internal combustion engine service precautions

The student will be able to explain how to diagnose engine performance
concerns
144. Diagnose engine noises and vibrations; determine necessary action
145. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air
dams, and fan control devices; perform necessary action
146. Identify hybrid vehicle internal combustion engine service precautions
147. Diagnose the cause of excessive oil consumption, coolant consumption,
unusual engine exhaust color and odor; determine necessary action
148. Perform engine vacuum tests; determine necessary action
149. Perform cylinder power balance tests; determine necessary action
150. Perform cylinder cranking and running compression tests; determine necessary
action
151. Perform cylinder leakage tests; determine necessary action
152. Remove and reinstall engine in OBDII or newer vehicle; reconnect all
attaching components and restore the vehicle to running condition
153. Install engine covers using gaskets, seals and sealers as required
154. Perform common fastener and thread repair, to include: remove broken bolt,
restore internal and external threads, and repair internal threads with thread
insert
155. Inspect, remove and replace engine mounts
156. Perform active tests of actuators using a scan tool; determine necessary action

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.