Butler Community College
Business, Technology, and Workforce
Development Division

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Revised Spring 2007
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COURSE OUTLINE
Engine Performance IV

Course Description
AT 204. Engine Performance IV. 3 hours credit. Prerequisite AT 201 with a C or better. This course will enable the student to develop necessary skills in On Board Diagnostics (OBD II) in order to diagnosis and repair fuel delivery systems, storage and evaporative control systems. The student will focus primarily on internal combustion fuel requirements, exhaust emissions; combustion efficiency, air induction and fuel trim parameters with an emphasis on electronically controlled fuel delivery systems.

Course Relevance
This course empowers the student with the ability to think and operate within systems encountered in automotive repair. The proliferation of electronics in modern automotive construction requires today's technician to diagnose interrelated components and systems in order to perform effective repair. The student will develop skills necessary for system diagnosis to repair the "cause" relative to the "symptom."

Required Materials
Halderman JD. (2007). *Automotive engine performance*. (2nd ed.). Upper Saddle River, NJ: Pearson Education Inc.

Supplemental Materials: Calculator and materials necessary to take notes, draw or trace diagrams and perform mathematical computations.

Learning Outcomes
The intention is for the student to be able to
1. Demonstrate comprehension of OBD II objectives
2. Demonstrate the ability to diagnose fuel delivery and evaporative control systems utilizing OBD II guide lines
3. Demonstrate comprehension of fuel injection components and operation
4. Diagnose and repair fuel injection and evaporative control system components

Primary Learning PACT Skills that will be DEVELOPED and/or documented in this course
Through the student's involvement in this course, he/she will develop his/her ability in the following primary PACT skill areas:
1. Field-Related Technology
   - The student will demonstrate Field-Related Technology through the diagnostic and repair process of fuel delivery systems and storage/evaporative control systems by selecting and properly utilizing tools that are specific to the assigned task.

Secondary skills (developed but not documented):

Reading
Listening
Teamwork

Major Summative Assessment Task(s

These learning outcomes and the primary Learning PACT skills will be demonstrated by

1. Completion of a final project consisting of a series of activities involving analyzing, diagnosing and repairing computer controlled fuel systems utilizing appropriate technology in an ethical performance of repair procedures.

Course Content

I. Themes – Key recurring concepts that run throughout this course:
   A. Assimilation of knowledge into meaningful “reasoning” processes
   B. Ethical, efficient work practices
II. Issues – Key areas of conflict that must be understood in order to achieve the intended outcome:
   A. Logical sequential procedures vs. “hit and miss” procedures
   B. The need to support intuitive thought with available data
III. Concepts – Key concepts that must be understood to address the issues:
   A. Fuel vaporization
   B. Vacuum
   C. Pressure
   D. Differential pressure
   E. Electronic principles
IV. Skills/Competencies – Actions that are essential to achieve the course outcomes:
   A. The student must comply with the personal and environmental safety practices associated with clothing, eye protection, hand tools, power equipment handling, storage and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations
   B. Diagnose hot or cold no-starting, hard starting, poor drive ability, incorrect idle speed, idle speed flooding, hesitation, surging, misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles equipped with fuel injection systems; determine needed action
   C. Inspect fuel tank and fuel cap; inspect and replace fuel lines, fittings and hoses.
   D. Check fuel for contaminates and quality
   E. Inspect and test mechanical and electric fuel pumps and pump control systems; replace as needed
   F. Replace fuel filters
   G. Inspect and test fuel pressure regulation system and components on fuel injection type fuel systems; adjust or replace as needed
   H. Inspect and test cold enrichment system components; adjust or replace as needed
   I. Remove, clean and reinstall throttle body; adjust related linkage
   J. Inspect and test fuel injectors; clean and replace

K. Inspect throttle body mounting plates, air induction, and filtration system, intake manifold and gaskets; clean and replace as needed
L. Check/Adjust idle speed and mixture where applicable
M. Remove, inspect, test vacuum and electrical components, connections of fuel system; repair or replace as needed
N. Perform exhaust system back pressure test; determine needed action
O. Test the operation of turbo-charger/supercharger components
P. Identify the causes of supercharger/turbocharger failure; determine needed action
Q. Remove, clean, inspect, and replace turbocharger/supercharger components
R. Diagnose emissions and drive-ability problems from failure of early fuel evaporation control systems
S. Inspect and test components of Early Fuel Evaporation control systems; service and repair as needed

Learning Units

I. On Board Diagnostics II
   A. On Board Diagnostics Generation II Systems
   B. Diagnostic executive and task manager
   C. Monitors
   D. Trouble code priority
   E. Enabling criteria
   F. OBD II drive cycle
   G. DTC numbering designation
   H. Freeze frame and failure records

II. The need for Fuel Trim
   A. Short term
   B. Long term
   C. Fuel Trim as a diagnostic aid
   D. Fuel Tim cells
   E. Trim Cell diagnosis
   F. Fuel Trim and Misfire codes
   G. Generic OBD II
   H. Diagnosis using mode six

III. Fuel injection components and operation
   A. Electronic fuel injection operation
   B. Speed density
   C. Mass airflow
   D. Throttle body injection
   E. Port fuel injection
   F. Direct injection with gasoline
   G. Fuel pressure regulator
   H. Vacuum biased fuel pressure

I. Electronic return less fuel system
J. Mechanical return less fuel system
K. Demand delivery system
L. Fuel injectors
M. C.P.I.
N. Modes of operation
O. Idle control
P. Stepper motor operation

Learning Activities
Learning activities will be geared toward achieving the intended course outcomes through lecture, group projects, trainers, presentations (individual and group), textbook reading assignments and hands on assignments within the lab.

Grade Determination
The student will be graded on assessment tasks, examinations, written and lab assignments and other methods of evaluation at the discretion of the instructor. Grades will reflect a compilation of lab and written assignments. Promptness, adherence to safety rules, team work, clean-up and class participation will be the traits evaluated in the lab.