ATOE-1200: BASIC MECHANICAL CONCEPTS

Cuyahoga Community College

Viewing: ATOE-1200 : Basic Mechanical Concepts

Board of Trustees:
SEPTEMBER 2025

Academic Term:
Fall 2025

Subject Code
ATOE - Appd Ind Tech-Operating Engin.

Course Number:
1200

Title:
Basic Mechanical Concepts

Catalog Description:
Introduction to analysis of fuels, components and principles of fuel systems, common units, air intake systems, cooling system designs and maintenance, hydraulic systems including Pascal's law, basics of engine electrical systems, history, development and theory of internal combustion engines. Discussion on function of clutches, basics of power train, use of brakes, and components of tracks and tire construction, selection, maintenance and storage.

Credit Hour(s):
3

Lecture Hour(s):
3

Lab Hour(s):
0

Requisites

Prerequisite and Corequisite
Departmental approval: Admissions to Operating Engineering Technology apprenticeship program.

Outcomes

Course Outcome(s):
N/A

Objective(s):
1. Identify various fuels and ingredients in relation to maintenance and performance of a machine.
2. Explain the principles of gasoline fuel system, its requirements, and turning gasoline fuel into mechanical power.
3. Define and discuss air intake system, various types of air cleaners and superchargers.
4. Explain and demonstrate how the cooling system operates, system designs, and maintenance to reduce owning and operation cost.
5. Discuss the development of hydraulic power and demonstrate/explain fundamental laws of hydraulics.
6. Identify engine electrical systems components and its purpose.
7. Discuss the history and principles of engine operations.
8. Identify various types of clutches and their functions.
9. Compare and contrast the components and various types of brakes.
10. Explain the components of track maintenance.
11. Differentiate types and sizes of tires and their construction.
12. Identify and explain the components of a hydraulic system.
13. Explain/demonstrate basic trouble-shooting procedure of engine electrical systems.
14. Explain how diesel engines differ from gasoline engines.
15. Demonstrate maintenance of clutch safety mechanisms.
16. Identify and explain gasoline and diesel engine components.
17. Demonstrate maintenance techniques on brakes.

Methods of Evaluation:

1. Quizzes
2. Exams
3. Classroom participation

Course Content Outline:

1. Combustion engines
   a. Introduction to four stroke engine
   b. Compression and fuels
   c. Selecting fuel(s) for gasoline engines
   d. Storage stability
   e. Gasoline additives and their functions
   f. Selecting fuel for diesel engines
   g. Diesel fuel characteristics
   h. Engine oil ratings and classifications
2. Basic principles of fuel systems
   a. Requirements of fuel systems
   b. In-line injection pumps
   c. Main parts of the pump
      i. drive shaft
      ii. distributor rotor
      iii. transfer pump
   d. Troubleshooting the diesel fuel system
3. Air systems
   a. Definition of air intake systems
   b. Types of air cleaners
   c. Air cleaning maintenance and service
   d. Types of superchargers
4. Cooling systems
   a. Function
   b. Types of cooling systems
      i. air cooling system
      ii. liquid cooling systems
      iii. radiators
   c. Thermostats
   d. Cooling system hose installation
   e. Antifreezes
   f. Servicing the cooling system
   g. Rust-proofing the system
   h. Cleaning and flushing the cooling system
   i. Cooling system leakage
5. Hydraulic systems
   a. Pascal"s law
   b. Simple hydraulic system
   c. Components of a hydraulic system
      i. hydraulic oil
      ii. reservoir
      iii. strainers, filters, breathers
   d. Pumps
   e. Hydraulic reservoirs
6. Electrical training
   a. Engine electrical systems
      i. purpose
      ii. components
   b. Storage batteries
   c. Battery interconnection

    i. series connection
    ii. parallel connection
  d. Cranking motors
  e. Ignition systems
  f. Storage battery
  g. Basic troubleshooting procedures
7. Engines
  a. History, development and theory of the internal combustion engine
    i. the importance of compression
    ii. otto engine
    iii. two-stroke versus four-stroke cycle
  b. Gasoline engine components
  c. Diesel engine components
  d. Engine power ratings
    i. indicated horsepower {IHP}
    ii. brake horsepower {BHP}
  e. Two and four-stroke cycle engines
    i. the four-stroke diesel
    ii. intake stroke
    iii. compression stroke
  f. How diesel engines differ from gasoline engines
  g. The two-stroke cycle diesel
8. Clutches
  a. Function of clutch
  b. Types of clutches types of clutch actuating devices
    i. pneumatic clutches
    ii. hydraulic clutches
  c. Clutch operating mechanisms
    i. electrical clutch controls
      1. direct-action
      2. in-direct action
    ii. dampeners
    iii. troubleshooting of clutches
  d. Maintenance of reciprocating drives
  e. Jump clutches
  f. Maintenance of safety mechanisms
    i. lubrication
    ii. general maintenance
9. Power trains
  a. How power is transmitted
  b. Friction drives
  c. Gear drives
  d. Types of gears
  e. Brakes
    i. mechanical brakes
    ii. internal expanding shoe type brakes
    iii. disc type brakes
    iv. engine brakes
    v. brake maintenance
    vi. brake troubleshooting
10. Tracks
  a. Purpose, components
  b. Track wear causes
    i. terrain conditions
    ii. environmental conditions
      1. soil conditions
      2. moisture
      3. temperature
    iii. operating conditions

iv. track adjustments
v. types of track drive systems
vi. maintenance practices

11. Tires
    a. Construction
    b. Tire selection
    c. Tire maintenance
    d. Storage

Resources

International Union of Operating Engineers, Local #18--Apprenticeship and Training. "Introductory Mechanics Training for Operating Engineers, First Year Student Workbook"

International Union of Operating Engineers, Local #18--Apprenticeship and Training. "Rough Terrain Forklife Training, Student Workbook"

(Monthly Publication). "Construction Equipment Magazine"

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