



**Format CO
COURSE OUTLINE**

ENGINE SERVICING I
Course Title

AM112
Dept. & Course No.

I. COURSE DESCRIPTION (same as in catalog)

This is an introductory course covering the basic principle of an internal combustion engine for Gas and Diesel engine (four stroke and two stroke engine). It also includes engine tuning, idling speed and engine timing adjustment for gas and diesel engine.

II. SEMESTER CREDITS: 2

III. CONTACT HOURS PER WEEK:

<u>1</u>	<u>3</u>	<u>4</u>
Lecture	Laboratory	Total

IV. PREREQUISITE: None

V STUDENTS LEARNING OUTCOME

Upon completion of this course the student will be able, with 65% level of accuracy, to:

- 1.) Name lubrication system parts and components and explain their functions as per repair manual specifications.

- 2.) Explain engine lubrication system operating principle.

- 3.) Change oil and filter in a correct procedure.

VI. COURSE CONTENT

- A. Lubrication system parts and components
 - 1.) Oil pump
 - 2.) Oil filter
 - 3.) Oil gallery
 - 4.) Relief valve
 - 5.) Types of engine oil
 - 6.) Engine oil viscosity index and quality
 - 7.) Oil strainer
 - 8.) Oil jet
 - 9.) Oil cooler
 - 10.) Oil passages

- B. Engine lubrication system operating principle
 1. Engine oil pressure
 2. Oil cycle
 3. Internal gear type oil pump
 4. External gear type oil pump
 5. Trochoid type oil pump

- C. Procedures in changing engine oil and filter
 1. Oil capacity
 2. Oil filter specification
 3. Proper handling of used oil
 4. Techniques in removing and

4.) Name engine cooling system parts and components and explain their functions as per repair manual specifications.

5.) Explain cooling system operating principles in both diesel and gasoline engines.

6.) Change engine coolant in a correct procedure.

7.) Explain internal combustion engine operating principles (2 stroke and 4 stroke cycle engine).

8.) Explain valve movement in 2, 3, 4, 5, 6, 8, and 10 cylinder engines as per repair manual specification.

installing oil filter

5. Diagnosing oil contamination

D. Cooling system parts and components

1. Radiator assembly
2. Radiator cap
3. Radiator hose
4. Radiator fan
5. Fluid coupling fan
6. Electric radiator fan
7. Thermostat
8. Engine coolant
9. Shroud
10. Water temperature sensor
11. Engine temperature sensor
12. Water pump
13. Water jacket
14. Water by-pass hose
15. Water reservoir tank
16. Coolant flush

E. Cooling system operating principle

1. Coolant flow and cycle
 - With and with-out thermostat
 - Racing engine and Commercial engine
2. Diesel engine coolant flow
3. Gasoline engine coolant flow

F. Procedure in changing engine coolant

1. Flushing coolant
2. Checking thermostat
3. Checking hoses
4. Checking core plugs
5. Checking water jacket
6. Checking radiator caps

G. Valve mechanism parts and components

1. Rocker arm
2. Camshaft pulley
3. Camshaft lobe
4. Crankshaft pulley
5. Rocker arm shaft
6. Valve shim

H. Operating principle of valve mechanism

1. Engine cycle
2. Engine firing order
3. Engine running mate

- 9.) Adjust valve clearance in a correct procedure.
 - 10.) Name carburetor parts and components and explain their functions as per repair manual specifications.
 - 11.) Explain carburetor operating principle (double barrel and variable type).
 - 12.) Clean carburetor assembly in a correct procedure.
 - 13.) Adjust carburetor adjusting mechanism in a correct specification.
 - 14.) Name engine parts and components and explain their functions as per repair manual specifications.
4. Engine timing
 5. Types of valve mechanism
 6. Valve clearance
 7. Piston and valve mechanism
- I. Procedures in adjusting valve clearance
 1. Adjust valve in two turns
 2. Adjust valve based on firing order
 3. Adjust valve based on crankshaft angle
 - J. Carburetor parts and components
 1. Air horn
 2. Venture
 3. Main jet
 4. Floater
 5. Pump plunger
 6. Pump jet
 7. Throttle valve
 8. Choke valve
 9. Carburetor mechanism
 - K. Carburetor circuits
 1. Float system
 2. Idling system
 3. Off idling circuit
 4. Acceleration circuit
 5. High speed circuit
 6. Full power circuit
 7. Choke system
 - L. Procedures in cleaning carburetor assembly
 1. Using solvent for cleaning
 2. Using carburetor cleaner
 3. Using pressurized air
 4. Using plastic scrapper
 - M. Carburetor mechanism and their specifications
 1. Engine idling adjuster
 2. Dashpot positioner
 3. Throttle positioner
 4. Unloader mechanism
 5. Fast idling mechanism
 6. Kick-up mechanism
 - N. Engine parts and components
 1. Top end components
 2. Bottom end components
 3. Front end components

- 15.) Check engine compression pressure in a correct procedure.
 4. Fuel injectors
 5. Distributor assembly
 6. Spark plug
- 16.) Check fuel system functionality and circuitry in a correct procedure.
 - O. Engine compression pressure
 1. Dry test
 2. Wet test
 3. Gasoline engine compression pressure specification
 4. Diesel engine compression pressure specification
 - P. Fuel system and their specification
 1. Fuel injector resistance value
 2. Fuel injector voltage input
 3. Circuit opening relay
 4. Fuel pump
 5. Fuel pressure
 6. Injection timing
- 17.) Check ignition system functionality and circuitry in a correct procedure.
 - Q. Ignition system and their specification
 1. Ignition system operating principle
 2. Ignition coil
 3. Distributor assembly
 4. High tension wires
 5. Types of spark plug
 6. Ignition timing
 7. Input voltage
 8. Reference voltage
- 18.) Check diesel engine pre-heating system
 - R. Diesel engine pre-heating system
 1. Types of glow plug
 2. Glow timer
 3. Glow plug relay

VII MATERIALS AND EQUIPMENT

Materials	Equipment
Engine oil (for gas engine)	OBD II (On-Board Diagnostic Generation II)
Engine oil (for Diesel engine)	Stethoscope
Oil filter	Fuel pressure gauge
Engine coolant	Compression tester (gas and diesel)
Spark plug	Diesel fuel injector tester
Shop rugs	Gas analyzer (gas & diesel)
Hand soap	Oscilloscope tester
Gasoline fuel	Gasoline Fuel injector tester
Diesel fuel	Timing light

Fuel filter	Oil pressure gauge
Gasket silicon	Digital multimeter
Vellumoid gasket	
Cork gasket	
Washing solvent	
Carburetor and injector cleaner	
Auto wire	
Carbon brush	
Wire connector and terminals	

VIII TEXT AND REFERENCES

- A Required Text:
 James E. Duffy, **Modern Automotive Technology**, Tinley Park Illinois,
 GOODHEART-WILLCOX COMPANY, INC. 2004
 ISBN-10: 1-59070-186-0
 ISBN-13: 978-1-59070-186-7

IX METHOD OF INSTRUCTION

- A. Lecture
- B. Visual Aid
- C. Demonstration
- D. Discussion

X METHOD OF EVALUATION:

- 1.) The components with corresponding weight in percent included in the computation of the final grade are:

Course work (quizzes / class works / homework / projects)	30%
Skill Tests	40%
Exam (Midterm and final exam)	30%

	100%

- 2.) The transmutation of the total percent to a letter grade is as of follows:

90 – 100	A
80 – 89	B
70 – 79	C
65 – 69	D
0 – 64	F



**Form NC-2
TASK LISTING SHEET**

AM112 ENGINE SERVICING I
Course No. & Title

Credits: 1 1 48
Lec. Lab Total lab hours

Laboratory objectives	Time allotment
1.) Change oil and filter in a correct procedure. a. Perform engine flushing to clean engine mechanical system. b. Change engine oil and filter c. Diagnose oil contamination that correlates to engine mechanical system problem.	3 hours
2.) Change engine coolant in a correct procedure. a. Clean engine cooling system with radiator cleaner. b. Change engine coolant with 50/50 water and coolant ratio. c. Check cooling system for leakage, contamination, and parts functionality.	7 hours
3.) Adjust valve clearance in a correct procedure. a. Adjust valve clearance for 2, 3, 4, 5, 6, 8, 10, and 12 cylinder engines. b. Adjust valves in two complete turns of crankshaft regardless of engine cylinder number. c. Adjust engine valves based on engine firing order. d. Adjust engine valve based on crankshaft angle regardless of engine cylinder number.	10 hours
4.) Clean carburetor assembly in a correct procedure. a. Clean double barrel carburetor. b. Clean variable type carburetor assembly. c. Clean Float system, Idling system, Off idling circuit, Acceleration circuit, High speed circuit, Full power circuit, and Choke system as per repair manual specifications.	8 hours
5.) Adjust carburetor adjusting mechanism in a correct specification. a. Adjust engine idling as per manufacturer specification. b. Adjust throttle positioner, unloader mechanism, fast idling, and kick-up mechanism as per repair manual specifications.	2 hours
6.) Check engine compression pressure in a correct procedure. a. Perform compression testing (dry test) to determine engine performance. b. Perform compression testing (wet test) to determine engine mechanical problems.	4 hours

<p>7.) Check fuel system functionality and circuitry in a correct procedure.</p> <ul style="list-style-type: none"> a. Check fuel pump operating, pressure, clarity and volume of fuel delivered, b. Check fuel pump power supply. c. Check relief valve performance. d. Check fuel injectors voltage supply and performance 	<p>4 hours</p>
<p>8.) Check ignition system functionality and circuitry in a correct procedure.</p> <ul style="list-style-type: none"> a. Explain the operating principle of ignition system for both conventional type and electronic type. b. Check ignition coil, igniter, and signal generator for functionality and circuitry. c. Check high tension wires, and spark plugs for functionality. 	<p>6 hours</p>
<p>9.) Check diesel engine pre-heating system</p> <ul style="list-style-type: none"> a. Explain the operating principle of diesel pre-heating system. b. Check glow plugs, heater timer, and relay for functionality and circuitry. 	<p>4 hours</p>



**PALAU COMMUNITY COLLEGE
AM112 ENGINE SERVICING I
COURSE LEARNING OUTCOMES**

During the course experience, the course learning outcomes (CLO's) will be assessed through the use of signature assignments. A rating scale will be used to determine the students' proficiency level of each CLO using specifically aligned assignments. The numerical ratings of 3, 2, and 1 are not intended to represent the traditional school grading system of A, B, C, D, and F. The descriptions associated with each of the numbers focus on the level of student performance of each of the course learning outcomes listed below:

Rating Scale:

- 3 Highly Competent 85% to 100%
- 2 Competent 70% to 84%
- 1 Beginner Below 70%

Course learning Outcome #1: Perform Engine Lubrication System Preventive Maintenance

Paper based assessment: Explain engine lubrication system operating principle, name lubrication system parts and components and explain their functions, and analyze cause and effect relationship involving engine lubrication system problems for both diesel and gasoline engines.

Authentic Assessment: Change oil and filter, Perform engine oil flushing, Check engine oil pressure, and/or Check engine oil leakage (internal and external).

Numerical Value	
Highly Competent 3 (10 points)	Student demonstrates the knowledge and skills in performing Engine Lubrication System Preventive Maintenance with 85% to 100% performance accuracy.
Competent 2 (7 points)	Student demonstrates the knowledge and skills in performing Engine Lubrication System Preventive Maintenance with 70% to 84% performance accuracy.
Beginner 1 (3 points)	Student demonstrates the knowledge and skills in performing Engine Lubrication System Preventive Maintenance with below 70% performance accuracy.

Course learning Outcome #2: Conduct Engine Cooling System Preventive Maintenance

Paper based assessment: Name engine cooling system parts and components and explain their functions, Explain cooling system operating principles for both diesel and gasoline engines, and analyze cause and effect relationship involving engine cooling system problems.

Authentic Assessment: Check cooling fan for functionality, Check radiator hose condition, Change engine coolant, clean water jacket and passages, and/or check engine overheating.

Numerical Value	
Highly Competent 3 (10 points)	Student demonstrates the knowledge and skills in conducting Engine Cooling System Preventive Maintenance with 85% to 100% performance accuracy.
Competent 2 (7 points)	Student demonstrates the knowledge and skills in conducting Engine Cooling System Preventive Maintenance with 70% to 84% performance accuracy.
Beginner 1 (3 points)	Student demonstrates the knowledge and skills in conducting Engine Cooling System Preventive Maintenance with below 70% performance accuracy.

Course learning Outcome #3: Service Engine Valve Mechanism

Paper based assessment: Name valve mechanism parts and components and explain the operating principle of valve mechanism, and analyze valve mechanism problems that affect engine performance.

Authentic Assessment: Adjust valve clearance, replace hydraulic type valve lifter, install camshaft sub-gears, check camshaft to crankshaft timing and/or Replace valve shim.

Numerical Value	
Highly Competent 3 (10 points)	Student demonstrates the knowledge and skills in servicing Engine Valve Mechanism with 85% to 100% performance accuracy.
Competent 2 (7 points)	Student demonstrates the knowledge and skills in servicing Engine Valve Mechanism with 70% to 84% performance accuracy.
Beginner 1 (3 points)	Student demonstrates the knowledge and skills in servicing Engine Valve Mechanism with below 70% performance accuracy.

Course learning Outcome #4: Service Carburetor Assembly

Paper based assessment: Name carburetor parts and components and explain their functions, explain carburetor operating principle (double barrel and variable type), and analyze cause and effect involving engine performance problems.

Authentic Assessment: Overhaul carburetor assembly, adjust engine idling, Adjust choke system, and/or Check carburetor vacuum hoses, and/or check solenoid valves for functionality,

Numerical Value	
Highly Competent 3 (10 points)	Student demonstrates the knowledge and skills in servicing Carburetor Assembly with 85% to 100% performance accuracy.
Competent 2 (7 points)	Student demonstrates the knowledge and skills in servicing Carburetor Assembly with 70% to 84% performance accuracy.

Beginner 1 (3 points)	Student demonstrates the knowledge and skills in servicing Carburetor Assembly with below 70% performance accuracy.
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Course learning Outcome #5: Perform Engine Tuning

Paper based assessment: Name engine parts and components and explain their functions, explain internal combustion engine operating principle (2 and 4 stroke cycle engine), explain ignition system, EFI fuel system, and diesel engine pre-heating system operating principle.

Authentic Assessment: Clean diesel fuel lines, Replace fuel filter for diesel and gasoline engines, Bleed air at fuel lines, Check fuel pump assembly, and clean spark plug, check spark plug high tension wires, and/or adjust engine timing.

Numerical Value	
Highly Competent 3 (10 points)	Student demonstrates the knowledge and skills in performing Engine Tuning with 85% to 100% performance accuracy.
Competent 2 (7 points)	Student demonstrates the knowledge and skills in performing Engine Tuning with 70% to 84% performance accuracy.
Beginner 1 (3 points)	Student demonstrates the knowledge and skills in performing Engine Tuning with below 70% performance accuracy.