



**Format CO
COURSE OUTLINE**

ENGINE SERVICING II

Course Title

AM 126

Dept and Course No.

I COURSE DESCRIPTION

This course is designed to enhance the knowledge, skills, and attitude of an individual in servicing engine mechanical components, overhauling the engine and servicing of diesel injection pump and injectors. The task involves in a complete dismantling and rebuilding of engine parts and components for both gasoline engine and diesel engine.

II SEMESTER CREDITS: 3

III CONTACT HOURS PER WEEK:

| | | | |
|--|----------|------------|----------|
| | <u>2</u> | <u>3</u> | <u>5</u> |
| | Lecture | Laboratory | Total |

IV PREREQUISITE: AM112

V STUDENTS LEARNING OUTCOMES

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

- 1.) Troubleshoot engine mechanical failure as per repair manual specifications.
- 2.) . Explain engine bolts and nuts torque specifications and tightening sequence.
- 3.) Tighten bolt and nuts as per repair manual specification.

VI. COURSE CONTENT

- A. Types of engine failure
 1. Engine low power
 2. Engine rough idling
 3. Engine high fuel consumption
 4. Engine knocking sound
- B. Engine specifications
 1. Bolts and nuts tensile
 2. Bolts and nuts threads
 3. Customary bolts
 4. Metric bolts
 5. Types of bolts and nuts
 6. Classifications of bolts and nuts
 - Plastic region bolt
 - Elastic region bolt
- C. Loosening and tightening bolts and nuts
 1. Cylinder head bolts
 2. Camshaft main cap bolts
 3. Crankshaft main cap bolts
 4. Connecting rod bolts
 5. Oil pan bolts
 6. Manifold bolts

4.) Identify engine mechanical failure

5.) Name engine top end parts and components and explain their functions as per repair manual specification.

6.) Explain engine valve mechanism operating principle.

7.) Service engine top end components as per repair manual specification.

8.) Name engine bottom end parts and components and explain their functions as per repair manual specification.

D. Procedures in solving engine mechanical failure.

7. Checking compression pressure
8. Checking oil pressure
9. Checking main bearing oil clearance
10. Checking connecting rod oil clearance
11. Checking valve clearance
12. Checking vacuum, oil, and water leakage

E. Engine top end components

1. Valve mechanism
2. Cylinder head assembly
3. Intake manifold
4. Exhaust manifold
5. Fuel injectors

F. Valve mechanism operating principle

1. OHV type
2. OHC type
3. DOHC type
4. QOHC type
5. Engine Firing Order
6. Classification of engine construction
7. Valve movement
8. Running mate
9. Cylinder head construction
10. Types of combustion chamber
11. Valve train construction
12. Valve train operating principle

G. Procedures in servicing engine top end components

1. Valve grinding
2. Valve seat refacing
3. Cylinder head refacing
4. Install valve spring assembly
5. Adjust valve clearance
6. Engine valve leak testing

H. Bottom end components

1. Cylinder block
2. Piston
3. Connecting rods
4. Crankshaft
5. Oil pan
6. Crankcase
7. Water jacket

9.) Explain engine clearances as per repair manual specification.

10.) Service bottom end components as per repair manual specification.

11.) Name engine front end parts and components and explain their functions as per repair manual specification.

12.) Explain engine camshaft and crankshaft timing operating principle.

13.) Service engine front end components as per repair manual specification.

14.) Clean engine parts in a correct procedure.

I. Bottom end parts clearance

1. Metal expansion
2. Thrust clearance
3. Oil clearance
4. Ring end clearance

J. Procedures in servicing bottom end components

1. Crankshaft
2. Piston and rings
3. Connecting rods
4. Water jackets
5. Oil galleries
6. Oil pan

K. Front end components

1. Rocker arm shaft
2. Camshaft
3. Rocker arms
4. Intake valve
5. Exhaust valve
6. Valve springs
7. Valve seat
8. Valve seals
9. Combustion chamber
10. Water hole
11. Water jacket
12. Oil hole
13. Valve cover and gasket
14. Cylinder head face and gasket

L. Engine timing operating principle

1. Engine cycle
2. Running mate
3. Timing marks
4. Firing order

M. Servicing engine front end components

- 1.) Engine timing belt
- 2.) Timing belt tension bearing
- 3.) Water pump assembly
- 4.) Front crankshaft oil seal
- 5.) Camshaft oil seal
- 6.) Timing chain
- 7.) Timing guide

N. Cleaning engine parts and components

- 1.) Cleaning procedures
- 2.) Piston
- 3.) Cylinder head
- 4.) Engine valves

15.) Overhaul engine assembly as per repair manual specifications.

- 5.) Cylinder block
- 6.) Manifolds

- O. Procedures in Overhauling engine assembly.
- 1.) Removing engine assembly
 - 2.) Dismantling engine parts and components.
 - 3.) Measures engine clearance.
 - 4.) Assembling parts and components.
 - 5.) Installing engine assembly

VII MATERIALS AND EQUIPMENT

| Materials | Equipment |
|--------------------------------|----------------------------|
| Engine oil (for gas engine) | Dial gauge |
| Engine oil (for Diesel engine) | Straight edge bar |
| Oil filter | Bore gauge |
| Engine coolant | Valve spring tension gauge |
| Spark plug | Plastic gauge |
| Shop rugs | Outside micrometer |
| Hand soap | |
| Gasoline fuel | |
| Diesel fuel | |
| Grinding compound | |
| Gasket silicon | |
| Vellumoid gasket | |
| Cork gasket | |
| Washing solvent | |
| Grinding stick | |
| Gasket cement | |
| Penetrating oil | |
| Bearing close fit | |
| Overhauling gasket | |
| Piston ring | |

VIII TEXT AND REFERENCES

- A. Required Text:
 James E. Duffy. **Modern Automotive Technology.** Tinley Park Illinois:
 GOODHEART-WILLCOX COMPANY, INC, 2004.

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**

AM126 ENGINE SERVICING II
Course No. & Title

Credits: 2
Lec. 1
Lab

48
Total lab hours

| Laboratory objectives | | Time allotment |
|-----------------------|---|----------------|
| 1. | <p>Troubleshoot engine mechanical failure as per repair manual specifications.</p> <ul style="list-style-type: none"> a. Check engine compression and analyze engine mechanical failure. b. Check engine knocking sound and analyze engine mechanical failure. c. Check engine power and analyze engine mechanical failure. | 4 hours |
| 2. | <p>Tighten bolt and nuts as per repair manual specification.</p> <ul style="list-style-type: none"> a. Tighten bolts and nuts for engine top end components to correct specification. b. Tighten bolts and nuts for front end components to correct specification. c. Tighten bolts and nuts for bottom end components to correct specification. d. Identify bolts and nuts torque specification (metric and customary bolts). | 3 hours |
| 3. | <p>Identify engine mechanical failure</p> <ul style="list-style-type: none"> a. Check compression pressure b. Check engine oil pressure c. Check main bearing oil clearance d. Check connecting rod oil clearance e. Check valve clearance f. Check vacuum, oil, and water leakage | 7 hours |
| 4. | <p>Service engine top end components as per repair manual specification.</p> <ul style="list-style-type: none"> a. Grind engine valves to correct specification. b. Perform cylinder head re-facing. c. Adjust valve clearance to correct specification. d. Check engine valve mechanism for smooth operating. | 5 hours |
| 5. | <p>Service bottom end components as per repair manual specification.</p> <ul style="list-style-type: none"> a. Check crankshaft thrust clearance for oil lubrication efficiency. b. Check piston to bore clearance for oil lubrication purposes. c. Check piston ring clearance for compression efficiency d. Check crankshaft main bearing oil clearance for oil lubrication efficiency. | 8 hours |
| 6. | <p>Service engine front end components as per repair manual specification.</p> <ul style="list-style-type: none"> a. Replace timing belt for maintenance purposes. b. Check timing chain tension for correct specification. | 7 hours |

| | | |
|----|---|----------|
| | <ul style="list-style-type: none"> c. Replace crankshaft front oil seal. d. Replace water pump assembly. e. Replace camshaft front oil seal. f. Replace timing belt tensioner bearing and idler bearing. | |
| 7. | <p>Clean engine parts in a correct procedure.</p> <ul style="list-style-type: none"> a. Clean parts for front end components to correct specification. b. Clean parts for top end components to correct specification. c. Clean parts for bottom end components to correct specification. | 4 hours |
| 8. | <p>Overhaul engine assembly as per repair manual specifications.</p> <ul style="list-style-type: none"> a. Remove engine assembly for overhauling preparation. b. Dismantle engine parts and components for cleaning preparations. c. Measure engine clearance to correct specifications. d. Assemble parts and components to correct specifications. e. Install engine assembly to correct specification. f. Check engine performance and fuel consumptions for correct specifications. | 10 hours |



**PALAU COMMUNITY COLLEGE
AM126 ENGINE SERVICING II
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: Troubleshoot Engine Mechanical Failure

Paper based assessment: Name engine parts and components and explain their functions and explain the operating principle of 2 and 4 stroke cycle engine and analyze Cause and Effect involving engine mechanical failure such as; cylinder head warpage, metal to metal contact, unusual engine knocking sound, low compression pressure, and high oil and fuel consumption.

Authentic Assessment: Measure engine compression pressure, Measure engine oil pressure, Check engine blow-by, Check engine valve clearance, and/or Check unusual engine knocking sound.

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

Course Learning Outcome #2: Service Engine Top End Components

Paper based assessment: Explain the cause and effect of combustion chamber designs, and explain the importance of engine valve scavenging event.

Authentic Assessment: Grind engine valves, Measure cylinder head warpage, Check valve spring square ness, Install valve train mechanism, Adjust engine valve clearance, and/or Test engine valve efficiency.

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

Course Learning Outcome #3: Service Engine Bottom End Components

Paper based assessment: Explain the importance of engine blocks shapes and design, explain piston stroke, compression ratio, horse power, engine size, and displacement.

Authentic Assessment: Clean engine block assembly, Install piston ring, Install piston assembly, Install crankshaft and bearing assembly, Install connecting rod and caps, Measure con-rod and main bearing oil clearance, Measure crankshaft thrust clearance, Measure piston protrusion, and/or Install oil pump and oil pan assembly.

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

Course Learning Outcome #4: Service Engine Front end Components

Paper based assessment: Explain the operating principle of Engine Front End Components and explain the importance of engine timing; camshaft and crankshaft timing.

Authentic Assessment: Replace camshaft oil seal, Replace crankshaft oil seal, Replace engine timing belt, Install timing chain, Install timing gear, Install timing cover, and/or Install water pump assembly.

| Numerical Value | |
|---|---|
| Highly Competent 3 (10 points) | Student demonstrates the knowledge and skills in servicing Engine Front end Components with 85% to 100% performance accuracy. |

| | |
|---------------------------------------|--|
| Competent 2 (7 points) | Student demonstrates the knowledge and skills in servicing Engine Front end Components with 70% to 84% performance accuracy. |
| Beginner 1 (3 points) | Student demonstrates the knowledge and skills in servicing Engine Front end Components with below 70% performance accuracy. |

Course Learning Outcome #5: Overhaul Engine Assembly

Paper based assessment: Explain the importance of engine measurements and their specifications and explain cause and effect involving engine measurement.

Authentic Assessment: Remove engine assembly, Dismantle engine parts, Clean engine parts, Measure engine mechanical oil clearance, Assemble engine parts, and/or Reinstall engine assembly.

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