



**Format CO  
COURSE OUTLINE (\*)**

**DRIVE TRAIN SERVICING**

Course Title

**AM 124**

Dept & Course No.

**I COURSE DESCRIPTION**

This course includes the knowledge, skills, and attitude needed to service power train components such as; servicing clutch system, servicing differential and front axle and overhauling of manual transmission for both transaxle type and longitudinal type. And it also includes troubleshooting of drive train noise and vibration.

**II SEMESTER CREDITS: 2**

**III CONTACT HOURS PER WEEK:**

1  
Lecture

3  
Laboratory

4  
Total

**IV PREREQUISITE: None**

**V. STUDENTS LEARNING OUTCOMES**

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

1. Name clutch system parts and components and explain their functions as per repair manual specifications.
2. Explain clutch system operating principles.
3. Service clutch system in a correct procedure.

**VI. COURSE CONTENT**

- A. Clutch system parts and components
  1. Flywheel
  2. Clutch disc
  3. Clutch pressure plate
  4. Clutch release bearing
  5. Clutch fork
  6. Clutch sleeve
  7. Clutch master
  8. Clutch pedal
  9. Clutch safety switch
- B. Operating principle of clutch system
  1. Clutch master assembly operating principle
  2. Clutch sleeve assembly operating principle
  3. Engaging and disengaging clutch principle.
  4. Multiplying engine torque
- C. Clutch system servicing procedure
  1. Overhaul clutch master
  2. Overhaul clutch sleeve

4. Name longitudinal type manual transmission and explain their function as per repair manual specifications.
  5. Explain the power flow of longitudinal type manual transmission.
  6. Service longitudinal type manual transmission as per repair manual specification.
  7. Name front drive shaft parts and components and explain their functions as per repair manual specifications.
  8. Explain the operating principle of front drive shaft assembly.
3. Remove and replace clutch disc, pressure plate, and bearing.
  4. Procedures in removing and installing transmission assembly
- D. Longitudinal type manual transmission parts and components
    1. Counter gears
    2. Speed gears
    3. Synchronizers
    4. Shifting fork
    5. Reverse gears
    6. Shifting linkage
    7. Inter locking balls
  - E. Operating principle of longitudinal type manual transmission
    1. Power flow of forward gears 1<sup>st</sup> gear to 5<sup>th</sup> gear.
    2. Power flow of reverse gear
    3. Floor shift type
    4. Column shaft type
    5. Neutral shifting
  - F. Longitudinal type manual transmission servicing procedures
    - a. Replace Shifting lever plastic ball
    - b. Check shifting fork tension spring
    - c. Input and output oil seal
    - d. Change gear oil
    - e. Replace speedometer driven gear
    - f. Overhaul longitudinal type manual transmission
  - G. Drive shaft parts and components
    - 1.) In-board and out-board C.V joint assembly.
    - 2.) Axle boot
    - 3.) Tri-pod bearing
    - 4.) Drive shaft oil seal
    - 5.) Drive shaft assembly
    - 6.) Tri-pod lock ring
  - H. Drive shaft operating principle
    1. Extending
    2. Compressing
    3. Rotating

9. Service front drive shaft as per vehicle specification.
10. Name transversal type manual transmission parts and components and explain their function as per vehicle specifications.
11. Explain the power flow of transversal type manual transmission as per vehicle specifications.
12. Service transversal type manual transmission as per vehicle specification.
13. Name transmission transfer case parts and components and explain their function as per vehicle specifications.
14. Explain transmission transfer case (manual Type) operating principle.
- I. Procedures in servicing drive shaft assembly
  1. Servicing C.V joint outboard assembly.
  2. Servicing C.V joint in-board assembly.
  3. Servicing tri-pod oil seal
- J. Transversal type manual transmission parts and components
  1. Input shaft
  2. Counter gear assembly
  3. Speed gear assembly
  4. Reverse gear assembly
  5. Output shaft
  6. Shifting mechanism
  7. Types of gear oil
- K. Power flow
  1. Forward gears
  2. Reverse gear
  3. Neutral
  4. Gear ratio
  5. Synchronization
  - 6.
- L. Procedures in servicing transversal type manual transmission
  1. Removing
  2. Dismantling
  3. Cleaning
  4. Installing parts and components
  5. Installing transmission assembly
- M. Transfer case parts and components
  1. Drive chain
  2. Sprocket gears
  3. Drive shaft
  4. Four-wheel drive shifting mechanism
  5. Drive gears for low speed
  6. Drive gears for high speed
- N. Four-wheel drive operating principle
  1. Power flow for low speed
  2. Power flow for high speed
  3. Power flow for neutral

15. Service transmission transfer case (manual type) as per vehicle specifications.
  16. Name rear differential and drive axle parts and components and explain their functions as per vehicle specifications.
  17. Explain differential and drive axle operating principles.
  18. Service rear differential assembly as per vehicle specification.
  19. Service drive axle assembly as per vehicle specification.
- O. Procedures in servicing manual transmission transfer case
    1. Removing Transmission Transfer Case
    2. Dismantling Transmission Transfer Case
    3. Cleaning Transmission Transfer Case
    4. Installing parts and components Transmission Transfer Case
    5. Installing transmission transfer case assembly
    6. Overhaul manual transmission transfer case
  - P. Rear differential and drive axle parts and components
    1. Differential pinion gear
    2. Differential ring gear
    3. Differential spider gear
    4. Drive axle shaft and bearing
  - Q. Operating principle of differential and drive axle
    1. Gear backlash
    2. Gear tooth contact
    3. Gear ratio
    4. Differential action
    5. Types of differential
  - R. Rear differential assembly servicing procedure
    1. Removal and dismantling of parts and components
    2. Cleaning parts and components
    3. Measuring bearing thrust clearances
    4. Assembling procedures
  - S. Drive axle assembly servicing procedure
    1. Removal and dismantling of parts and components
    2. Cleaning parts and components
    3. Measuring bearing thrust clearance
    4. Assembling procedures

## VII MATERIALS AND EQUIPMENT

Materials	Equipment
Gear oil GL-4 SAE 140	Manual / Automatic transmission puller
Gear oil GL-5 fully synthetic based / multi grade	Axle puller
Gear oil for limited slip differential	Transmission jack
Vellumoid gasket	
Silicon gasket	
Shop rug	
Washing solvent	
Multi purpose grease	
High temperature grease	
Hand soap	

## VIII TEXT AND REFERENCES

- A Required Text:  
 Duffy, James E. **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%
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	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**

**AM- 124 DRIVE TRAIN SERVICING**

Course No. & Title

Credits: 1      1      48  
Lec.      Lab      Total lab hours

Laboratory objectives		Time allotment
1.	<b>Service clutch system in a correct procedure.</b> a. Adjust clutch pedal height and clearance b. Check clutch system for functionality c. Bleed clutch system d. Overhaul clutch master and clutch slave cylinder e. Remove and replace clutch disc, pressure plate, release bearing, and pilot bearing.	<u>8 hours</u>
2.	<b>Service longitudinal type manual transmission as per repair manual specification.</b> a. Replace Shifting lever plastic ball b. Check shifting fork tension spring c. Input and output oil seal d. Change gear oil e. Replace speedometer driven gear f. Overhaul longitudinal type manual transmission	<u>8 hours</u>
3.	<b>Service front drive shaft as per vehicle specification.</b> a. Remove and replace axle boot inner and outer. b. Remove and replace in-board and outboard assembly. c. Lubricate C.V joint outboard assembly. d. Lubricate tripod bearing, seal, and housing.	<u>3 hours</u>
4.	<b>Service transversal type manual transmission as per vehicle specification.</b> a. Replace Shifting lever mechanism plastic ball b. Check shifting fork tension spring c. Replace input and output oil seal d. Change gear oil e. Replace speedometer driven gear f. Overhaul transversal type manual transmission	<u>8 hours</u>

5.	<p><b>Service transmission transfer case (manual type) as per vehicle specifications.</b></p> <ul style="list-style-type: none"> <li>a. Remove Transmission Transfer Case</li> <li>b. Dismantle Transmission Transfer Case</li> <li>c. Clean Transmission Transfer Case</li> <li>d. Install parts and components of Transmission Transfer Case</li> <li>e. Install transmission transfer case assembly</li> <li>f. Overhaul manual transmission</li> </ul>	<u>8 hours</u>
6.	<p><b>Service rear differential assembly as per vehicle specification.</b></p> <ul style="list-style-type: none"> <li>a. Change differential gear oil</li> <li>b. Check and adjust pinion gear to ring gear tooth contact.</li> <li>c. Check and adjust pinion to ring gear backlash clearance.</li> <li>d. Check pinion bearing clearance.</li> <li>e. Overhaul differential assembly.</li> </ul>	<u>8 hours</u>
7.	<p><b>Service drive axle assembly as per vehicle specification.</b></p> <ul style="list-style-type: none"> <li>a. Remove and replace universal joint.</li> <li>b. Remove and replace drive shaft center bearing support.</li> <li>c. Check drive shaft balancing.</li> <li>d. Lubricate drive shaft universal joint.</li> </ul>	<u>5 hours</u>



**PALAU COMMUNITY COLLEGE**  
**AM-124 DRIVE TRAIN SERVICING**  
**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: Service Clutch System**

**Paper based assessment:** Name parts and components of clutch system and explain their functions, explain the operating principle of clutch system, and analyze cause and effect involving clutch system problem.

**Authentic Assessment:** Replace clutch master repair kit, replace clutch auxiliary sleeve repair kit, adjust clutch pedal free play, remove manual transmission assembly, check pilot bearing, replace clutch lining and pressure plate, replace clutch release bearing, and/or install manual transmission assembly.

Numerical Value	
<b>Highly Competent</b> 3 (10 points)	Student demonstrates the knowledge and skills in servicing Clutch System with 84% to 100% performance accuracy.
<b>Competent</b> 2 (7 points)	Student demonstrates the knowledge and skills in servicing Clutch System with 70% to 84% performance accuracy.
<b>Beginner</b> 1 (3 points)	Student demonstrates the knowledge and skills in servicing Clutch System with below 70% performance accuracy.

**Course learning Outcome #2: Service Longitudinal Type Manual Transmission**

**Paper based assessment:** Name longitudinal type manual transmission parts and components and explain their function, sketch the power flow of 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, and reverse gear based on longitudinal type manual transmission, and analyze cause and effect involving Longitudinal Type Manual Transmission problem.



**Authentic Assessment:** Replace Shifting lever plastic ball, Check shifting fork tension spring, Input and output oil seal, Change gear oil, Replace speedometer driven gear, and/or Overhaul longitudinal type manual transmission.

Numerical Value	
<b>Highly Competent</b> 3 (10 points)	Student demonstrates the knowledge and skills in servicing Longitudinal Type Manual Transmission with 85% to 100% performance accuracy.
<b>Competent</b> 2 (7 points)	Student demonstrates the knowledge and skills in servicing Longitudinal Type Manual Transmission with 70% to 84% performance accuracy.
<b>Beginner</b> 1 (3 points)	Student demonstrates the knowledge and skills in servicing Longitudinal Type Manual Transmission with below 70% performance accuracy.

### Course learning Outcome #3: Service Front Drive Shaft

**Paper based assessment:** Name front drive shaft parts and components and explain their functions, Explain the operating principle of front drive shaft assembly, and analyze cause and effect involving Front Drive Shaft problem.

**Authentic Assessment:** Remove and replace front drive shaft assembly, service C.V joint outboard and in-board assembly, replace axle boot, and/or service tripod oil seal.

Numerical Value	
<b>Highly Competent</b> 3 (10 points)	Student demonstrates the knowledge and skills in servicing Front Drive Shaft with 85% to 100% performance accuracy.
<b>Competent</b> 2 (7 points)	Student demonstrates the knowledge and skills in servicing Front Drive Shaft with 70% to 84% performance accuracy.
<b>Beginner</b> 1 (3 points)	Student demonstrates the knowledge and skills in servicing Front Drive Shaft with below 70% performance accuracy.

### Course learning Outcome #4: Service Transversal Type Manual Transmission Assembly

**Paper based assessment:** Name transversal type manual transmission parts and components and explain their function, sketch the power flow 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, and reverse gear based on transversal type manual transmission, and analyze cause and effect involving Transversal Type Manual Transmission problem.

**Authentic Assessment:** Dismantle transversal type manual transmission assembly, check transmission gear shifting, synchronizer assembly, and differential gear backlash, overhaul transversal type manual transmission and/or install transmission assembly.

Numerical Value	
<b>Highly Competent</b> 3 (10 points)	Student demonstrates the knowledge and skills in servicing Transversal Type Manual Transmission Assembly with 85% to 100% performance accuracy.
<b>Competent</b> 2 (7 points)	Student demonstrates the knowledge and skills in servicing Transversal Type Manual Transmission Assembly with 70% to 84% performance accuracy.
<b>Beginner</b> 1 (3 points)	Student demonstrates the knowledge and skills in servicing Transversal Type Manual Transmission Assembly with below 70% performance accuracy.

### Course learning Outcome #5: Service Manual Transmission Transfer Case

**Paper based assessment:** Name transmission transfer case parts and components and explain their function, sketch the power flow of 4L, 4H, 2H, and neutral, and analyze cause and effect involving manual Transmission Transfer Case problem.

**Authentic Assessment:** Dismantle transfer case assembly, check shifting rail and fork, check shifting mechanism for 2-wheel and 4-wheel, overhaul transfer case gear box assembly, install transfer case gear box assembly, and/or install transfer case assembly.

Numerical Value	
<b>Highly Competent</b> 3 (10 points)	Student demonstrates the knowledge and skills in servicing Manual Transmission Transfer Case with 85% to 100% performance accuracy.
<b>Competent</b> 2 (7 points)	Student demonstrates the knowledge and skills in servicing Manual Transmission Transfer Case with 70% to 84% performance accuracy.
<b>Beginner</b> 1 (3 points)	Student demonstrates the knowledge and skills in servicing Manual Transmission Transfer Case with below 70% performance accuracy.

### Course learning Outcome #6 Service Rear differential and Drive Axles

**Paper based assessment:** Name rear differential and drive axle parts and components and explain their functions, Explain differential and drive axle operating principles, and analyze cause and effect involving Rear differential and Drive Axles problem.

**Authentic Assessment:** Remove rear differential assembly, measure differential gear and ring gear backlash, check pinion gear bearing load, check pinion gear tooth contact, service rear drive axle assembly, install axle bearing, install axle bearing retainer, install axle bearing shim, and/or install rear axle assembly.

<b>Numerical Value</b>	
<b>Highly Competent</b> <b>3</b> <b>(10 points)</b>	Student demonstrates the knowledge and skills in servicing Rear differential and Drive Axles with 85% to 100% performance accuracy.
<b>Competent</b> <b>2</b> <b>(7 points)</b>	Student demonstrates the knowledge and skills in servicing Rear differential and Drive Axles with 70% to 84% performance accuracy.
<b>Beginner</b> <b>1</b> <b>(3 points)</b>	Student demonstrates the knowledge and skills in servicing Rear differential and Drive Axles with below 70% performance accuracy.