

RARITAN VALLEY COMMUNITY COLLEGE ACADEMIC COURSE OUTLINE

AUTC 116 Automatic & Manual Transmission

I. Basic Course Information

A. Course Number and Title: AUTC 116 – Automatic & Manual Transmissions

B. New or Modified Course: Modified

C. Date of Proposal: Semester: Fall Year: 2022

D. **Effective Term: Fall 2023**

E. Sponsoring Department: Science & Engineering

F. Semester Credit Hours: 3

G. Weekly Contact Hours: 5 Lecture: 2
Laboratory: 3
Out of class student work per week: 5.5

H. Prerequisite (s) ☐ Corequisite (s) ☐ **OR** Prerequisite (s) and Corequisite (s) ☒:
Pre-requisite: AUTC 101 – Automotive Introduction, Fundamentals, and Safety
Corequisites: AUTC 210 – Suspension & Steering Systems
AUTC 205 – Automotive Cooling & Climate Control Systems
AUTC 202 – Engine Performance and Diagnosis I
(Students must be registered in the same section for each course)

I. Additional Fees: None

J. Name and Telephone Number or E-Mail Address of Department Chair and Divisional Dean at time of approval:

Department Chair: Marianne Baricevic, Marianne.baricevic@raritanval.edu

Divisional Dean: Sarah Imbriglio, sarah.imbriglio@raritanval.edu

II. Catalog Description

Pre-requisite: AUTC 101 – Automotive Introduction, Fundamentals, and Safety.

Corequisites: AUTC 210 – Suspension & Steering Systems

AUTC 205 – Automotive Cooling & Climate Control Systems

AUTC 202 – Engine Performance and Diagnosis I
(Students must be registered in the same section for each course)

This course will cover the theoretical understanding of principles, maintenance, and adjustments required for today's automatic and manual transmissions and their components. This includes torque converters, clutches, transaxles, drive shafts, final drives, and all-wheel drive units. Students will experience the installation and adjustment of clutches, manual transmissions, automatic transmissions, universal joints, axles, drive shafts, and other drive train components. Diagnosis and service of transmissions and drive train components are included.

In the lab, students will learn a hands-on strategy to perform basic maintenance of manual transmissions, automatic transmissions, clutches, torque converters, axles, and drive train components. Students will also learn how to use a variety of hand tools and precision measurement tools. Students will be required to wear clothing appropriate for auto shop safety at all classes. Safety glasses will also be required at all classes.

III. Statement of Course Need

- A. Automotive technicians are vital to our mobile and transport-dependent community. Understanding the structure and function of automatic and manual transmissions, clutches, and drive train systems in automobiles and their maintenance are integral elements for the education of well-trained technicians in the field. Students need to be familiar with the basic hydraulic principles for all transmissions. Service and adjustments which can be done to the transmissions are a key part of maintenance and life expectancy of the unit. Efficiency, performance and compliance with EPA regulations (State and Federal) are mandatory in this field as well as customer satisfaction. This course is intended to enhance the student's knowledge beyond understanding.
- B. Lab assignments for the course will introduce students to the basic maintenance and repair of automatic and manual transmissions, and drive train components, while maintaining instruction that reinforces the safety practices in a demonstrative environment.
- C. Course transferability: The course transfers as one of the core fundamental courses for the Automotive Technology major and includes a laboratory component; for New Jersey schools go to the NJ Transfer website, www.njtransfer.org. For all other colleges and universities, go to their individual websites.

IV. Place of Course in College Curriculum

- A. Free Elective
- B. This course meets the program requirement for the Automotive Technology Certificate and the Associate of Applied Science in Automotive Technology.

- C. Course transferability; for New Jersey schools go to the NJ Transfer website, www.njtransfer.org. For all other colleges and universities go to their individual sites.

V. Outline of Course Content

- A. Safety and Driveline Layout
- B. Special Tools and Applications
- C. Automatic Transmission/Transaxle
 - a. Principles
 - b. Components
 - c. Control systems
 - d. Diagnosis
 - e. Service
 - f. Repair
- D. Manual Transmissions
 - a. Principles
 - b. Components
 - c. Control systems
 - d. Diagnosis
 - e. Service
 - f. Repair
- E. Drive Train
 - a. Drive Axles
 - i. Principles
 - ii. Components
 - iii. Control systems
 - iv. Diagnosis
 - v. Service
 - vi. Repair
 - b. Drive Shafts
 - i. Principles
 - ii. Components
 - iii. Control systems
 - iv. Diagnosis
 - v. Service
 - vi. Repair
 - c. Differentials
 - i. Principles
 - ii. Components
 - iii. Control systems
 - iv. Diagnosis
 - v. Service
 - vi. Repair
 - d. Transfer Cases
 - i. Principles

- ii. Components
 - iii. Control systems
 - iv. Diagnosis
 - v. Service
 - vi. Repair
- F. Four Wheel Drive
 - a. Principles
 - b. Components
 - c. Control systems
 - d. Diagnosis
 - e. Service
 - f. Repair
- G. All Wheel Drive
 - a. Principles
 - b. Components
 - c. Control systems
 - d. Diagnosis
 - e. Service
 - f. Repair

VI. A. Course Learning Outcomes

At the completion of the course, students will be able to:

1. Analyze the structure and function of automatic and manual transmissions, clutches, and drive train systems in use in automobiles.
2. Inspect, test, and replace automatic and manual transmissions, clutches, and drive train components according to manufacturer's specifications.
3. Examine automatic and manual transmissions, clutches, and drive train components and identify appropriate tools and measuring instruments used during diagnosis and repair.
4. Recognize environmental and safety concerns related to maintenance procedures for transmission systems.
5. Discuss the theory regarding the influence of computer controls on transmission and all-wheel drive systems.
6. Perform lab experiments and tasks to competent skill level as listed on the NATEF curriculum standards.
7. Identify techniques to troubleshoot, repair, maintain, and solve problems related to automotive and manual transmissions, clutches, and drive train systems (GE NJ 4)
8. Apply quantitative reasoning to problems with the maintenance of automotive systems (GE NJ 2)
9. Discuss issues involving automotive systems (GE NJ 1)

NATEF Standards: All Automatic Transmission & Transaxle

- a. General: Transmission & Transaxle Diagnosis

- i. Identify and interpret transmission/transaxle concerns, differentiate between engine performance and transmission/transaxle concerns; determine needed action. P-1
 - ii. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
 - iii. Diagnose fluid loss and condition concerns; determine needed action. P-1
 - iv. Check fluid level in a transmission or a transaxle equipped with a dipstick. P-1
 - v. Check fluid level in a transmission or a transaxle not equipped with a dipstick. P-1
 - vi. Perform pressure tests (including transmissions/transaxles equipped with electronic pressure control); determine needed action. P-1
 - vii. Diagnose noise & vibration concerns; determine needed action P-2
 - viii. Perform stall test; determine needed action. P-2
 - ix. Perform lock-up converter system tests; determine needed action P-3
 - x. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles P-1
 - xi. Diagnose electronic transmission/transaxle control systems using appropriate test equipment and service information. P-1
 - xii. Diagnose pressure concerns in a transmission using hydraulic principles (Pascal's Law). P-2
- b. In-Vehicle Transmission/Transaxle Maintenance & Repair
 - i. Inspect, adjust, and/or replace external manual valve shift linkage, transmission range sensor/switch, and/or park/neutral position switch. P-1
 - ii. Inspect for leakage; replace external seals, gaskets, and bushings P-2
 - iii. Inspect, test, adjust, repair, and/or replace electrical/electronic components and circuits including computers, solenoids, sensors, relays, terminals, connectors, switches, and harnesses; demonstrate understanding of the relearn procedure. P-1
 - iv. Drain and replace fluid and filter(s); use proper fluid type per manufacturer specification. P-1
 - v. Inspect, replace and align powertrain mounts. P-2
- c. Off-Vehicle Transmission & Transaxle Repair
 - i. Remove and reinstall transmission/transaxle and torque converter; inspect engine core plugs, rear crankshaft seal, dowel pins, dowel pin holes, and mounting surfaces. P-2
 - ii. Inspect, leak test, flush, and/or replace transmission/transaxle oil cooler, lines, and fittings. P-1
 - iii. Inspect converter flex (drive) plate, converter attaching bolts, converter pilot, converter pump drive surfaces, converter end play, and crankshaft pilot bore. P-2
 - iv. Describe the operational characteristics of a continuously variable transmission (CVT). P-3
 - v. Describe the operational characteristics of a hybrid vehicle drive train. P-3
 - vi. Disassemble, clean, and inspect transmission/transaxle. P-1

- vii. Inspect, measure, clean, and replace valve body (includes surfaces, bores, springs, valves, switches, solenoids, sleeves, retainers, brackets, check valves/balls, screens, spacers, and gaskets). P-2
- viii. Inspect servo and accumulator bores, pistons, seals, pins, springs, and retainers; determine needed action. P-2
- ix. Assemble transmission/transaxle. P-1
- x. Inspect, measure, and reseal oil pump assembly and components. P-2
- xi. Measure transmission/transaxle end play and/or preload; determine needed action. P-1
- xii. Inspect, measure, and/or replace thrust washers and bearings. P-2
- xiii. Inspect oil delivery circuits, including seal rings, ring grooves, and sealing surface areas, feed pipes, orifices, and check valves/balls. P-2
- xiv. Inspect bushings; determine needed action. P-2
- xv. Inspect and measure planetary gear assembly components; determine needed action. P-2
- xvi. Inspect case bores, passages, bushings, vents, and mating surfaces; determine needed action. P-2
- xvii. Diagnose and inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform needed action. P-2
- xviii. Inspect measure, repair, adjust, or replace transaxle final drive components. P-2
- xix. Inspect clutch drum, piston, check-balls, springs, retainers, seals, friction plates, pressure plates, and bands; determine needed action. P-2
- xx. Measure clutch pack clearance; determine needed action. P-1
- xxi. Air test operation of clutch and servo assemblies. P-1
- xxii. Inspect one-way clutches, races, rollers, sprags, springs, cages, retainers; determine needed action. P-2

NATEF Standards: AIII Manual Drive Train & Axles

- a. General: Drive Train Diagnosis
 - i. Identify and interpret drive train concerns; determine needed action. P-1
 - ii. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
 - iii. Check fluid condition; check for leaks; determine needed action. P-1
 - iv. Drain and refill manual transmission/transaxle and final drive unit; use proper fluid type per manufacturer specification. P-1
- b. Clutch Diagnosis & Repair
 - i. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine needed action. P-1
 - ii. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform needed action. P-1
 - iii. Inspect and/or replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing, linkage, and pilot bearing/bushing (as applicable) P-1
 - iv. Bleed clutch hydraulic system. P-1
 - v. Check and adjust clutch master cylinder fluid level; check for leaks; use proper fluid type per manufacturer specification. P-1

- vi. Inspect flywheel and ring gear for wear, cracks, and discoloration; determine needed action. P-1
- vii. Measure flywheel runout and crankshaft end play; determine needed action. P-2
- viii. Describe the operation and service of a system that uses a dual mass flywheel. P-3
- c. Transmission/Transaxle Diagnosis and Repair
 - i. Inspect, adjust, lubricate, and/or replace shift linkages, brackets, bushings, cables, pivots, and levers. P-2
 - ii. Describe the operational characteristics of an electronically-controlled manual transmission/transaxle. P-2
 - iii. Diagnose noise concerns through the application of transmission/transaxle powerflow principles. P-2
 - iv. Diagnose hard shifting and jumping out of gear concerns; determine needed action. P-2
 - v. Diagnose transaxle final drive assembly noise and vibration concerns; determine needed action. P-3
 - vi. Disassemble, inspect clean, and reassemble internal transmission/transaxle components. P-2
- d. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair (Front, Rear, All-wheel, and Four-wheel drive)
 - i. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine needed action. P-1
 - ii. Diagnose universal joint noise and vibration concerns; perform needed action. P-2
 - iii. Inspect, remove, and/or replace bearings, hubs, and seals. P-1
 - iv. Inspect, service, and/or replace shafts, yokes, boots, and universal/CV joints. P-1
 - v. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles. P-2
- e. Drive Axle Diagnosis and Repair
 - E.1. Ring and Pinion Gears and Differential Case Assembly
 - i. Clean/inspect differential case; check for leaks; inspect housing vent. P-1
 - ii. Check and adjust differential case fluid level; use proper fluid type per manufacturer specification. P-1
 - iii. Drain and refill differential case; use proper fluid type per manufacturer specification. P-1
 - iv. Diagnose noise and vibration concerns; determine needed action. P-2
 - v. Inspect and replace companion flange and/or pinion seal; measure companion flange runout. P-2
 - vi. Inspect ring gear and measure runout; determine needed action. P-3
 - vii. Remove, inspect, reinstall and/or replace drive pinion and ring gear, spacers, sleeves, and bearings. P-3
 - viii. Measure and adjust drive pinion depth. P-3
 - ix. Measure and adjust drive pinion bearing preload. P-3

- x. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types). P-3
 - xi. Check ring and pinion tooth contact patterns; perform needed action. P-3
 - xii. Disassemble, inspect, measure, adjust, and/or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, & case. P-3
 - xiii. Reassemble and reinstall differential case assembly; measure runout; determine needed action. P-3
- E.2. Limited Slip Differential
 - i. Diagnose noise, slippage, chatter concerns; determine needed action. P-3
 - ii. Measure rotating torque; determine needed action. P-3
- E.3. Drive Axles
 - i. Inspect and replace drive axle wheel studs. P-1
 - ii. Remove and replace drive axle shafts. P-1
 - iii. Inspect and replace drive axle shaft seals, bearings, and retainers. P-2
 - iv. Measure drive axle flange runout and shaft end play; determine needed action. P-2
 - v. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine needed action. P-2
- f. Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair
 - i. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets. P-3
 - ii. Inspect locking hubs; determine needed action. P-3
 - iii. Check for leaks at drive assembly and transfer case seals; check vents; check fluid level; use proper fluid type per manufacturer specification. P-3
 - iv. Identify concerns related to variations in tire circumference and/or final drive ratios P-2
 - v. Diagnose noise, vibration, and unusual steering concerns; determine needed action. P-3
 - vi. Diagnose, test, adjust, and/or replace electrical/electronic components of four-wheel drive/all-wheel drive systems. P-2
 - vii. Disassemble, service, and reassemble transfer case and components. P-2

B. Assessment Instruments

1. Lectures
2. Demonstrations
3. Laboratory work
4. Instructional videos/DVDs
5. Laboratory performance
6. Examinations
7. NATEF task list
8. Online modules
9. Manufacturer programs

VII. Grade Determinants

- A. Lab performance
- B. Examinations
- C. Class participation
- D. Technical writing
- E. Interactive simulations
- F. Module completion
- G. Homework assignments

Primary formats, modes, and methods for teaching and learning that may be used in the course:

- A. Lecture/discussion
- B. Small-group work
- C. Group discussion
- D. Computer-assisted instruction
- E. Laboratory
- F. Simulation/role playing
- G. Demonstration
- H. Student collaboration
- I. Individual assignments
- J. Electude
- K. Manufacturer training

VIII. Texts and Materials

- A. Suggested Text: Automotive Technology: Principles, Diagnosis, and Service Plus MyAutomotiveLab with Pearson eText -- Access Card Package / Edition 5 by James D. Halderman (Author), Prentice Hall Publishing ISBN-10: 0134009088 / ISBN-13: 9780134009087
- B. Students will be required to wear clothing appropriate for auto shop safety at all classes. Student are required to wear a standard industry uniform. Safety glasses will also be required at all classes.
- C. The Automotive Program utilizes online curriculum and online industry service and repair information from the following sources:
 - I. AllData
 - II. Snap On Industries
 - III. Shop Key Pro.
 - IV. Electude
 - V. Manufacturer Training
- D. Various Automotive Magazines

- E. Students are provided the use of RVCC technology during the course

Please note: The course outline is intended only as a guide to course content and resources. Do not purchase textbooks based on this outline. The RVCC Bookstore is the sole resource for the most up-to-date information about textbooks.

IX. Resources

- A. Reference books
- B. AllData
- C. Shop Key Pro
- D. Snap On Industries
- E. NAPA Pro-Link
- F. Published Automotive Magazines
- G. Lab/Shop Tools and Equipment
- H. CDX Interactive Courseware
- I. Safety equipment
- J. Lubricants and various automotive fluids
- K. Sample automotive system components
- L. Instructional videos/DVDs
- M. Auto mechanics shop facility at RVCC workforce building
- N. Electude
- O. Manufacturer Training