

RARITAN VALLEY COMMUNITY COLLEGE ACADEMIC COURSE OUTLINE

AUTC 210 – Suspension & Steering Systems

I. Basic Course Information

- A. Course Number and Title: AUTC 210 – Suspension & Steering Systems
- B. New or Modified Course: Modified
- C. Date of Proposal: Fall 2022
- D. Effective Term: Fall 2023**
- E. Sponsoring Departments: *Science and Engineering Department*
- F. Semester Credit Hours: 4
- G. Weekly Contact Hours: 6 Lecture: 3
 Laboratory: 3
 Out of class student work per week: 7.5
- H. ☐ Prerequisite (s)
 ☐ Corequisite (s)
 ☒ Prerequisite (s) and Corequisite (s)
 Prerequisite: AUTC 101 - Automotive Introduction, Fundamentals, and Safety
 AUTC 109 – Brake Systems
 Corequisites: AUTC 205 – Automotive Cooling & Climate Control Systems
 AUTC 202 – Engine Performance and Diagnosis I
 AUTC 116 Automatic & Manual Transmission
 (Students must be registered in the same section for each course)
- I. Additional Fees: No
- J. Name and Telephone Number or Email 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

Prerequisite: AUTC 101 - Automotive Introduction, Fundamentals, and Safety
AUTC 109 – Brake Systems

Corequisites: AUTC 205 – Automotive Cooling & Climate Control Systems
AUTC 202 – Engine Performance and Diagnosis I
AUTC 116 Automatic & Manual Transmission
(Students must be registered in the same section for each course)

This course will cover the theory involved in front and rear suspension, steering geometric angles, weight distribution, wheel balancing, alignment, advanced steering & suspension systems, tire wear, & stability control systems. The alignment angles and procedures will prepare students to diagnose tire wear and road tracking issues in order to complete necessary alignment adjustments to vehicles. Practice is provided in diagnosing and servicing the steering & suspension systems of an automobile as well as performing the alignment adjustments to correct the tire wear and pull of an automobile.

In the lab, students will perform basic maintenance of steering & suspension systems, diagnostic strategies of steering angles and alignments, and learn how to use a variety of diagnostic tools, 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. Technicians are needed that understand steering geometry and are able to think abstractly. The demand for these people will never decrease as vehicles are constantly being improved and upgraded. Understanding the structure and function of steering and suspension systems in automobiles and their maintenance are integral elements for the education of well-trained technicians in the field. 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 student's knowledge beyond understanding and to enable students to improve their knowledge of advanced steering & suspension, and how it works with anti-lock brakes systems, and build critical thinking skills to improve diagnostic skills. Understanding the operation of advanced steering, suspension, and ABS systems in automobiles and their maintenance are integral elements for the education of well-trained technicians in the field.
- B. Lab assignments for the course will introduce students to the maintenance and repair of steering and suspension components as well as the advanced diagnostic strategies, and alignment, while maintaining instruction that reinforces the safety practices in a demonstrative environment.
- C. Course transferability: This course generally transfers as a free elective, but may transfer as a program elective to Pennsylvania College of Technology for those students graduating with the AAS in Automotive Technology who are interested in pursuing a B.S. degree at that institution.

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

1. Tires and wheels
2. Tire and wheel service
3. Tire pressure monitoring system
4. Suspension system principles and components
5. Front suspensions and service
6. Rear suspensions and service
7. Electronic suspension systems
8. Steering columns and gears
9. Steering linkage and service
10. Electric and hydraulic power steering systems
11. Wheel alignment principles
12. Alignment diagnosis and service

VI. A. Course Learning Outcomes

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

1. Analyze the structure and function of components of advanced steering, suspension, and alignments.
2. Compare and contrast advanced steering and suspension systems relating to the alignment angles and type of systems.
3. Inspect, test, and replace advanced steering and suspension components according to manufacturer's specifications.
4. Diagnose steering and suspension alignment angles.
5. Perform lab experiments and tasks to competent skill level as listed on the NATEF curriculum standards.
6. Identify techniques to troubleshoot, repair, maintain, and solve problems with varied automotive steering and suspension systems (GE NJ 4)
7. Apply quantitative reasoning to solve problems with automotive steering and suspension systems (GE NJ 2)
8. Discuss issues involving automotive steering and suspension systems (GE NJ 1)

NATEF Standards: AIV Suspension & Steering

- a. General: Suspension and Steering Systems
 - i. Research vehicle service information including fluid type, vehicle service history, service precautions, and technical service bulletins P-1
 - ii. Identify and interpret suspension and steering system concerns; determine needed action P-1
- b. Steering System Diagnosis & Repair
 - i. Disable and enable supplemental restraint system (SRS); verify indicator lamp operation. P-1
 - ii. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring). P-1
 - iii. Diagnose steering column noises, looseness, and binding concerns (including tilt/telescoping mechanisms); determine needed action. P-2
 - iv. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action. P-2
 - v. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and noise concerns; determine needed action. P-2
 - vi. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; determine needed action. P-2
 - vii. Remove and replace rack and pinion steering gear; inspect mounting bushings and brackets. P-2
 - viii. Inspect rack and pinion steering gear inner tie rod ends (sockets) and bellows boots; replace as needed. P-1
 - ix. Inspect power steering fluid level and condition. P-1
 - x. Flush, fill, and bleed power steering system; use proper fluid type per manufacturer specification. P-2
 - xi. Inspect for power steering fluid leakage; determine needed action. P-1
 - xii. Remove, inspect, replace, and/or adjust power steering pump drive belt. P-1
 - xiii. Remove and reinstall power steering pump. P-2
 - xiv. Remove and reinstall press fit power steering pump pulley; check pulley and belt alignment. P-2
 - xv. Inspect, remove and/or replace power steering hoses and fittings. P-2
 - xvi. Inspect, remove and/or replace pitman arm, relay (centerlink/intermediate) rod, idler arm, mountings, and steering linkage damper. P-2
 - xvii. Inspect, replace, &/or adjust tie rod ends (sockets), tie rod sleeves, & clamps. P-1
 - xviii. Inspect, test and diagnose electrically- assisted power steering systems (including using a scan tool); determine needed action. P-2
 - xix. Identify hybrid vehicle power steering system electrical circuits and safety precautions. P-2
 - xx. Test power steering system pressure; determine needed action. P-2
- c. Suspension System Diagnosis and Repair
 - i. Diagnose short and long arm suspension system noises, body sway, and uneven ride height concerns; determine needed action. P-1
 - ii. Diagnose strut suspension system noises, body sway, and uneven ride height concerns; determine needed action. P-1
 - iii. Inspect, remove, and/or replace upper and lower control arms, bushings, shafts, and rebound bumpers. P-3
 - iv. Inspect, remove, and/or replace strut rods and bushings. P-3

- v. Inspect, remove, and/or replace upper and/or lower ball joints (with or without wear indicators). P-2
- vi. Inspect, remove, and/or replace steering knuckle assemblies. P-3
- vii. Inspect, remove and/or replace short and long arm suspension system coil springs and spring insulators. P-3
- viii. Inspect, remove, and/or replace torsion bars and mounts P-3
- ix. Inspect, remove, and/or replace front/rear stabilizer bar (sway bar) bushings, brackets, and links. P-3
- x. Inspect, remove, and/or replace strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount. P-3
- xi. Inspect, remove, and/or replace track bar, strut rods/radius arms, and related mounts and bushings. P-3
- xii. Inspect rear suspension system leaf spring(s), spring insulators (silencers), shackles, brackets, bushings, center pins/bolts, and mounts. P-1
- d. Related Suspension and Steering Service
 - i. Inspect, remove, &/or replace shock absorbers; inspect mounts & bushings. P-1
 - ii. Remove, inspect, service and/or replace front and rear wheel bearings. P-1
 - iii. Describe the function of suspension and steering control systems and components, (i.e. active suspension and stability control). P-3
- e. Wheel Alignment Diagnosis, Adjustment, and Repair
 - i. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine needed action. P-1
 - ii. Perform prealignment inspection; measure vehicle ride height; determine needed action. P-1
 - iii. Prepare vehicle for wheel alignment on alignment machine; perform four-wheel alignment by checking and adjusting front and rear wheel caster, camber and toe as required; center steering wheel. P-1
 - iv. Check toe-out-on-turns (turning radius); determine needed action. P-2
 - v. Check steering axis inclination (SAI) and included angle; determine needed action. P-2
 - vi. Check rear wheel thrust angle; determine needed action. P-1
 - vii. Check for front wheel setback; determine needed action. P-2
 - viii. Check front &/or rear cradle (subframe) alignment; determine needed action. P-3
 - ix. Reset steering angle sensor. P-2
- f. Wheels and Tires Diagnosis and Repair
 - i. Inspect tire condition; identify tire wear patterns; check for correct tire size, application (load and speed ratings), and air pressure as listed on the tire information placard/label. P-1
 - ii. Diagnose wheel/tire vibration, shimmy, and noise; determine needed action. P-2
 - iii. Rotate tires according to manufacturer's recommendation including vehicles equipped with tire pressure monitoring systems (TPMS) P-1
 - iv. Measure wheel, tire, axle flange, and hub runout; determine needed action. P-2
 - v. Diagnose tire pull problems; determine needed action. P-1
 - vi. Dismount, inspect, & remount tire on wheel; balance wheel & tire assembly. P-1
 - vii. Dismount, inspect, and remount tire on wheel equipped with tire pressure monitoring system sensor. P-1
 - viii. Inspect tire and wheel assembly for air loss; perform needed action. P-1
 - ix. Repair tire following vehicle manufacturer approved procedure. P-1

- x. Identify indirect and direct tire pressure monitoring system (TPMS); calibrate system; verify operation of instrument panel lamps. P-1
- xi. Demonstrate knowledge of steps required to remove and replace sensors in a tire pressure monitoring system (TPMS) including relearn procedure P-1

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