Course Title: Intermediate Automotive Collision Repair & Refinishing

Hours: Lecture 6 Hours/Week
Lab 9 Hours/Week

Course Description: Theory and practical experience in automotive collision repair and refinishing, shop safety practices, personal safety and health protection, with a focus on MIG welding/aluminum, major frame repair, measuring and analyzing collision damage, operating electronic measuring systems, Sheet Molded Compound (SMC) panel replacement, heat reshaping plastic parts, electrical and electronic systems, two stage/three stage refinishing systems, spot repair/blending, polishing and detailing, and introduction estimating, introduction to custom painting. This course may be used in preparation for the Automotive Service Excellence (ASE) National Test.

**Rationale:** Rewriting the course title and description to reflect the latest changes in technology.

Extra hours are needed to cover the lecture because of the complexity of today's paint systems and the increased number of Regulations of the South Coast Air Quality Management District (SCAQMD) and the Environmental Protection Agency (EPA), as well as city and county regulations.

Last updated: 3/99

SAN BERNARDINO VALLEY COLLEGE
COURSE OUTLINE

I. CATALOG DESCRIPTION:
Division: TECHNICAL Department: AUTOMOTIVE
Course ID Number: AUTO 048#3
Course Title: Intermediate Automotive Collision Repair & Refinishing
Hours: Lecture 6 Hours/Week
Lab 9 Hours/Week
Units: 9
Course Description: Theory and practical experience in automotive collision repair and refinishing, shop safety practices, personal safety and health protection, with a focus on MIG welding/aluminum, major frame repair, measuring and analyzing collision damage, operating electronic measuring systems, Sheet Molded Compound (SMC) panel replacement, heat reshaping plastic parts, electrical and electronic systems, two stage/three stage refinishing systems, spot repair/blending, polishing and detailing, and introduction estimating, introduction to custom painting. This course may be used in preparation for the Automotive Service Excellence (ASE) National Test.
Prerequisite(s): AUTO 039#3
Corequisite(s): None

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: Three
Rationale for Repeatability:
A. The requirements of the Automotive Service Excellence (ASE) Certifications are continually updated and require tremendous amounts of knowledge and skills in order to pass the certification test. To remain certified, technicians must test every five years to become proficient with the changes in technology which occur every model year and often twice in a model year.
B. The South Coast Air Quality Management District (SCAQMD) Rules and Regulations are being updated continually.
C. The Occupational Safety and Health Act (OSHA) Rules and Regulations are being updated continually; for example, respirator users must be trained annually.

III. EXPECTED OUTCOMES FOR STUDENTS:
Upon completion of this course, students will be able to:
A. Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals in accordance with local, state, and federal safety and environmental regulations including, but not limited to, the regulatory departments such as the Occupational Safety and Health Act (OSHA), Bureau of Automotive Repair (BAR), South

Coast Air Quality Control Board (SCAQCB), Environmental Protection Agency (EPA).

B. Apply knowledge and skills attained to pass the Automotive Service Excellence (ASE) National Test.

C. Complete National Automotive Technicians Education Foundation (NATEF) Task List:

1. Painting and Refinishing (Test B2)

a. Surface Preparation

1. Remove, asses, and store trim and moldings.
2. Remove, dirt, road grime, wax or other protective coatings from area to be refinished and adjacent vehicle surfaces.
3. Inspect and identify substrate, type of finish, and surface condition; develop a plan for refinishing.
4. Remove paint finish.
5. Dry or wet sand areas to be refinished.
6. Featheredge areas to be refinished
7. Identify type of substrate and apply suitable treatment or primer.
8. Mask trim, and protect other areas that will not be refinished.
9. Mix primer, primer-surfacer, or sealer; spray onto surface of repaired area.
10. Apply two-component putty to minor surface imperfections.
11. Dry or wet sand area to which primer-surfacer and/or two-component putty have been applied.
12. Remove dust from area to be refinished, including cracks or moldings of adjacent areas.
13. Clean area to be refinished using a proper cleaning solution.
14. Remove, with a tack rag, any dust or lint particles from the area to be refinished.
15. Apply suitable sealer to the area being refinished when sealing is needed or desirable.
16. Remove imperfections from sealer.
17. Prepare the repaired and adjacent areas for blending.
18. Apply stone chip-resistant coating.
19. Restore corrosion resistant coatings, caulking, and seam sealers to repaired areas.
20. Remove decals, transfers, tapes, woodgrains, pinstripes (painted and taped), etc

b. Spray Gun Operation and Related Equipment

1. Inspect, clean, and determine condition

spray guns and adequacy of related equipment (air hoses, regulator, air lines, air source, filtration unit and spray environment).
2. Check and adjust spray gun pressure for siphon-feed, pressure-feed, gravity-feed, HVLP (high volume, low pressure) and LVLP (low volume, low pressure) guns.
3. Adjust spray gun using fluid and pattern control valves.
4. Select correct spray gun, needle, fluid tip, and air cap for material being sprayed.
5. Force-dry refinishing materials.

c. Paint Mixing, Matching, and Applying
1. Determine type and color finish already on vehicle.
2. Identify paint color formula and proper usage of mixing equipment and materials.
3. Shake, stir, reduce, catalyze, and strain refinish material according to manufacturer’s recommendations.
4. Use appropriate spray technique (gun arc, gun angle, gun distance, gun speed, and spray pattern overlap) for finish being applied.
5. Apply selected product on test panel or let-down panel in accordance with vehicle/refinishing manufacturer’s recommendations.
6. Apply single stage topcoat for spot and panel refinishing, and overall refinishing.
7. Apply basecoat for spot and panel blending, and overall refinishing.
8. Apply multi-stage (mica, pearl, etc.) coats for spot repair, panel blending, and overall refinishing.
9. Apply clearcoat.
10. Check color match; adjust as necessary.
11. Identify the types of rigid, or flexible plastic parts to be refinished; determine the proper materials and refinishing procedures.
12. Refinish rigid, soft, or flexible plastic parts.
13. Refinish interior components, upholstery, dashes, and vinyl tops.

d. Solving Paint Application Problems
1. Identify blistering (raising of the refinished surface); determine the cause(s), and correct the condition.
2. Identify contaminants in the refinished surface; determine the source(s), and

correct the condition.

3. Identify contaminants in the refinished surface; determine the source(s), and correct the condition.
4. Identify a dry spray appearance in the refinished surface; determine the causes(s), and correct the condition.
5. Identify the presence of fish-eyes (crater-like openings) in the refinished surface; determine the cause(s), and correct the condition.
6. Identify the lifting (surface distortion or shriveling) of the refinished surface; determine the cause(s), and correct the condition.
7. Identify mottling or streaking in metallic and mica paint finishes; determine the cause(s), and correct the condition.
8. Identify excessive texture (orange peel) appearance of the refinished surface; determine the causes(s), and correct the condition.
9. Identify an overspray condition; determine the cause(s), and correct the condition.
10. Identify solvent popping or pin-holing in the refinished surface; determine the cause(s), and correct the condition.
11. Identify sags and runs in the refinished surface; determine the causes(s), and correct the condition.
12. Identify sandscratch swelling in the refinished surface; determine the cause(s), and correct the condition.
13. Identify shrinking or splitting while the finish is curing; determine the cause(s), and correct the condition.
14. Identify color mismatch; determine the cause(s), and correct the condition.
15. Identify tape tracking; determine the cause(s), and correct the condition.
16. Identify loss of gloss in the refinished surface; determine the cause(s), and correct the condition.

e. Finish Defects, Causes, and Cures

1. Identify poor adhesion; determine the cause(s), and correct the condition.
2. Identify finish cracking (crowsfeet or line-checking, micro-checking, etc.); determine the cause(s), and correct the condition.
3. Check for rust spots (corrosion); determine the cause(s), and correct the

condition.
4. Identify blistering in the finish surface; determine the cause(s), and correct the condition.
5. Identify water spotting on finish surface; correct the condition.
6. Identify finish damage causes by bird droppings, tree sap, and other natural causes; correct the condition.
7. Identify finish damage caused by airborne contaminants, (acids, soot, rail dust, and other industrial-related causes); correct the condition.
8. Identify die-back conditions (dulling of the paint film showing haziness, or film distortion showing shrinking); correct the condition.
9. Identify chalking (oxidation); correct the condition.
10. Identify body filler bleed-through or staining; correct the condition.
11. Identify solvent popping or pin-holing; correct the condition.
12. Identify damage caused by buffing painted surfaces; correct the condition.
13. Identify film defect from too much or too little film build; measure finish film thickness.
14. Sand and polish minor surface imperfections.

f. Safety Precautions and Miscellaneous
1. Identify and take necessary precautions with hazardous operations and materials according to EPA regulations.
2. Identify and correct hazards to employee health and safety according to OSHA/NIOSH guidelines.
3. Inspect spray environment for health and safety hazards.
4. Select proper respiratory protection system; inspect to insure proper fit, operation, and maintenance.
5. Apply decals, transfers, tapes, woodgrains, pinstripes (painted and taped), etc.

2. Non-structural Analysis and Damage Repair (Test B3)

a. Preparation
1. Review damage report; analyze damage to determine appropriate methods for overall repair.
2. Lift, raise, and position vehicle to perform repairs.
3. Remove outside trim and moldings as

necessary; store reusable parts.

4. Remove damaged or undamaged inside trim and moldings as necessary; store reusable parts.
5. Remove undamaged, non-structural body panels and components that may interfere with or be damaged during repair.
6. Remove all vehicle mechanical and electrical components that may interfere with or be damaged during repair.
7. Protect panels and parts adjacent to repair area to prevent damage during repair.
8. Remove dirt, grease, wax, and other contaminants from areas to be repaired.
9. Remove pinstripes, emblems and decals (transfers/overlays, woodgrains).
10. Remove corrosion protection, undercoatings, sealers, and other protective coatings as necessary to perform repairs.
11. Remove repairable plastics and other parts that are recommended for off-vehicle repair.
12. Identify potential safety and environmental concerns associated with vehicle components and systems, i.e. ABS, air bags (SRS), refrigerants, coolants, etc.
13. Determine repair procedures in accordance with the vehicle manufacturer's specifications and industry procedures.

b. Outer Body Panel Repairs, Replacements, and Adjustments

1. Determine the extent of the direct and indirect damage and the direction of impact; plan the methods and order of repair.
2. Remove and replace bolted, bonded, and welded panels or panel assemblies.
3. Determine the extent of damage to aluminum body panels; repair, weld, or replace.
4. Remove, replace, and align hood, hood hinges, and hood latch/lock.
5. Remove, replace, and align deck lid, lid hinges, and lid latch/lock.
6. Remove and replace doors, tailgates, hatches, lift gates, latch/lock assemblies, and hinges.
7. Remove, replace, and align bumpers, reinforcements, guards, absorbers, isolators, and mounting hardware.
8. Check and adjust clearances of front

fenders, header, and other panels.

9. Check door hinge condition and alignment, adjust or replace as necessary, and adjust door clearances.
10. Straighten contours of damaged panel to a surface condition suitable for metal finishing or body filling.
11. Weld cracked or torn metal body panels; reweld damaged welds; replace molding studs.
12. Apply protective coatings and sealants to restore corrosion protection.
13. Remove damaged sections of metal body panels; weld in replacements.
14. Repair door frame, repair or replace door skins; inspect intrusion beams.
15. Replace or repair plastic panels.
16. Restore sealers, mastic, sound deadeners, and foam fillers.
17. Diagnose and repair water leaks, dust leaks, wind noise, squeaks, and rattles.
18. Install interior and exterior trim and moldings.

c. Metal Finishing and Body Filling
   1. Remove paint from the damaged area of a body panel.
   2. Metal finish the damaged area of a body panel to eliminate surface irregularities.
   3. Heat shrink stretched panel areas to proper contour.

d. Glass and Hardware
   1. Repair or replace power sun/moon roofs and related controls.
   2. Inspect, adjust, and install convertible top and related mechanisms.

e. Welding and Cutting
   1. Perform test welds. Visually inspect and perform destructive test.
   2. Identify safety considerations: Eye protection, proper clothing, respiratory protection, shock hazards, fumes, material safety data sheet (MSDS), etc. before beginning any welding operation.

f. Plastic Repair
   1. Identify the types of plastic(s); determine repairability.
   2. Identify the proper plastic repair procedure; clean and prepare the surfaces of plastic parts.
   3. Repair plastic parts by welding or using repair materials (adhesives, reinforcing materials).
   4. Retexture plastic parts.

5. Repair vinyl-clad urethane foam parts.
6. Remove damaged areas from rigid exterior SMC (sheet-molded compound); repair with partial panel installation.
7. Repair deep gouges, holes, and cracks in SMC (sheet-molded compound) panels.
8. Replace bonded SMC (sheet molded compound) body panels; straighten or align panel supports.
9. Replace mechanically fastened or bonded non-SMC plastic body panels; straighten or align panel supports.

3. Structural Analysis and Damage Repair (Test B4)
   a. Frame Inspection and Repair
      1. Diagnose structural damage using tram, self-centering gauges, or three-dimensional measuring systems (mechanical, electronic/computerized, laser) in accordance with industry specifications.
      2. Anchor vehicle for realignment.
      3. Straighten and align mash/collapse damage (change in length).
      4. Straighten and align sag/kickup damage (change in height).
      5. Straighten and align sidesway/sway damage (change from centerline).
      6. Straighten and align twist damage.
      7. Straighten and align diamond damage.
      8. Repair or replace damaged frame horns, side rails, cross members, frame brackets, supplemental restraint system (SRS) mounts, and front or rear sections in accordance with vehicle manufacturer’s/industry standards.
      9. Restore corrosion protection to repaired or replaced frame areas.
      10. Repair or replace stress-cracked frame members in accordance with vehicle manufacturer’s/industry standards.
      11. Diagnose misaligned or damaged steering, suspension, and powertrain components which can cause vibration, steering, and wheel alignment problems; align or replace steering and suspension components in accordance with vehicle manufacturer’s/industry standards.
   b. Unibody Inspection, Measurement, and Repair
      1. Recognize that measuring, dimensioning, and tolerance limits in unibody vehicles are critical to repair of these vehicles; recognize that suspension/steering mounting points and engine/powertrain attaching points are critical to vehicle

handling, performance, and safety.

2. Diagnose misaligned or damaged steering, suspension, and powertrain components which can cause vibration, steering, and wheel alignment problems; realign or replace steering and suspension components in accordance with vehicle manufacturer's/industry standards.
3. Diagnose and analyze vehicle damage using a gauge measuring system (tram and self-centering).
4. Identify the control points of all suspension, steering, powertrain, and supplemental restraint system (SRS) component attaching points.
5. Diagnose and measure unibody vehicles using a dedicated (fixture) measuring system.
6. Diagnose and measure unibody vehicles (upper and lower body dimensions) using a universal measuring system (mechanical, electronic/computerized, laser).
7. Determine the extent of direct and indirect damage, and the direction of impact; plan the methods and sequence of repair.
8. Anchor vehicle for realignment.
9. Straighten and align center section. (Cowl, bulkhead, roof, roof rails, pillars, floor, windshield/back glass openings, door openings, rocker panels, and floor pans).
10. Straighten and align rear section. (Quarter panels, rear compartment opening, wheelhouse assemblies, rear body panel, rails, suspension, and powertrain mounting points).
11. Straighten and align front sections. (Aprons, strut towers, upper and lower rails, steering, suspension, and powertrain mounting points).
12. Recognize the limitations of applying heat to high-strength steel (HSS) structural components.
13. Use cold stress relief methods.
14. Remove folds, curves, creases, and dents, using power tools and hand tools, to restore damaged areas to proper contours and dimensions.
15. Determine the extent of damage to structural steel body panels; repair or replace in accordance with vehicle manufacturer's/industry standards.
16. Restore corrosion protection to repaired

or replaced unibody structural areas.

c. Metal Welding and Cutting
    1. Identify weldable and non-weldable materials and components used in vehicle construction.
    2. Understand the limitations of welding and cutting high-strength steels (HSS) and aluminum.
    3. Determine correct welding process [GMAW (MIG), compression/resistance spot, GTAW (TIG)], electrode, wire type, diameter, and gas to be used in specific welding situations.
    4. “Tune” the MIG welder by adjusting for proper electrode stickout, voltage, polarity, flow rate, and wire speed required for the material being welded.
    5. Identify safety considerations: Eye protection, proper clothing, shock hazards, fumes, etc. before beginning any welding operation.
    6. Understand the proper procedures for safely handling gas cylinders.
    7. Ensure proper work clamp (ground) location.
    8. Use the proper gun-to-joint angle, and the direction of gun travel, for welds being made in all positions.
    9. Protect vehicle components, including computers and other electronic modules, from possible damage from welding and cutting operations.
    10. Clean the metal to be welded; assure good metal fit-up; apply weld-through primer.
    11. Identify the type of weld joint (butt, lap, etc.) for the repair being made.
    12. Determine the correct type of weld (continuous, stitch/pulse, tack, plug, spot, etc.) and preparation for each specific welding operation.

4. Mechanical and Electrical Components (Test B5)

a. Suspension and Steering
    1. Identify suspension system fasteners which should not be reused.
    2. Inspect and replace rack and pinion steering gear, inner tie rod ends, and bellows boots.
    3. Remove and replace power steering pump; belts, hoses, and fittings; inspect pump mounts.
    4. Remove and replace power steering gear (non-rack and pinion type).
    5. Remove and replace power rack and pinion steering gear; inspect and replace

mounting bushings and brackets; ensure proper mounting location.

6. Inspect and adjust (where applicable) steering linkage geometry (attitude/parallelism).
7. Inspect and replace pitman arm.
8. Inspect and replace relay (center link/intermediate) rod.
9. Remove and replace idler arm and mountings.
10. Remove and replace tie rod sleeves, clamps, and tie rod ends.
11. Remove and replace steering linkage damper.
12. Remove and replace upper and lower control arms.
13. Remove and replace upper and lower ball joints on short and long arm suspension systems.
14. Remove and replace steering knuckle/spindle/hub assemblies.
15. Remove and replace coil springs and spring insulators (silencers).
16. Inspect, replace, adjust front suspension system torsion bars and inspect mounts.
17. Inspect and replace MacPherson strut cartridge or assembly, upper bearing, and mount.
18. Inspect, remove and replace rear suspension system transverse links, control arms, stabilizer bars, bushings and mounts.
19. Inspect, remove and replace rear suspension system leaf spring(s), leaf spring insulators (silencers), shackles, brackets, bushings and mounts.
20. Inspect and replace shock absorbers, air shock absorbers, load-leveling devices, air springs, and associated lines and fittings.
21. Diagnose, inspect, adjust, repair, or replace components of electronically controlled suspension systems.
22. Measure vehicle ride height; determine needed repairs.
23. Remove, replace, and align front and rear subframes.
24. Diagnose steering column damage, looseness, and binding problems (including tilt mechanisms); determine needed repairs.
25. Diagnose manual and power steering gear (non-rack and pinion type) noises, binding, uneven turning effort,

looseness, hard steering and lubricant leakage problems; determine needed repairs.

26. Diagnose manual and power rack and pinion steering gear noises, vibration, looseness, and hard steering problems; ensure proper mounting location.
27. Inspect and replace steering shaft U-joint(s), flexible coupling(s), collapsible columns, and steering wheels.
28. Diagnose front and rear suspension system noises and body sway problems; determine needed repairs.
29. Diagnose vehicle wandering, pulling, hard steering, bump steering, memory steering, torque steering, and steering return problems; determine needed repairs.
30. Check and adjust front and rear wheel camber on suspension systems with camber adjustments.
31. Check front and rear wheel camber on non-adjustable suspension system; determine needed repairs.
32. Check and adjust caster on suspension systems with caster adjustments.
33. Check caster on non-adjustable suspension systems; determine needed repairs.
34. Check and adjust front wheel toe; center steering wheel if necessary.
35. Identify toe-out-turns (turning radius) related problems; determine needed repairs.
36. Identify SAI (steering axis inclination)/KPI (king pin inclination) related problems; determine needed repairs.
37. Check rear wheel toe; determine needed repairs.
38. Identify thrust angle related problems; determine needed repairs.
39. Check for front wheel setback; determine needed repairs.
40. Diagnose wheel/tire vibration, shimmy, and tramp (wheel hop) problems; determine needed repairs.

b. Electrical

1. Check voltages in electrical wiring circuits with a DMM (digital multimeter); determine repair procedure.
2. Check continuity and resistance in electrical wiring circuits and components with a DMM (digital multimeter); determine repair procedure.
3. Check electrical circuits, wiring, and

connectors; repair according to manufacturers' specifications.

4. Inspect, test, and replace fusible links, circuit breakers, and fuses.
5. Inspect, clean, and replace battery, battery cables, connectors, and clamps.
6. Perform slow/fast battery charge in accordance with manufacturers' recommendations.
7. Identify programmable electrical/electronic components; record data for reprogramming before disconnecting battery.
8. Inspect, test, and repair or replace switches, relays, bulbs, sockets, connectors, and wires of all light circuits including four-wire taillight systems.
9. Remove and replace power seat, motors, linkages, cables, etc; check operation.
10. Remove and replace components of keyless lock/unlock devices and alarm systems; check operation.
11. Remove and replace electrical components of electrical sunroof or convertible top; check operation.
12. Check operation of electrically heated mirrors, windshields, backlights, panels, etc.; repair as necessary.

c. Brakes

1. Select, handle, store, and install brake fluids (including silicone fluids).
2. Bleed (manual, pressure, vacuum, or surge) and/or flush hydraulic brake system in accordance with manufacturers' procedures.
3. Pressure test brake hydraulic system; determine needed repairs.
4. Adjust brake shoes; reinstall brake drums or drum/hub assemblies and wheel bearings.
5. Remove and replace caliper assembly.
6. Identify and replace ABS wheel speed sensor components according to manufacturers' specifications.
7. Depressurize ABS hydraulic system according to manufacturers' specifications.

d. Heating and Air Conditioning

1. Identify type of refrigerant and refrigerant oil.
2. Recover refrigerant from A/C system.
3. Evacuate and recharge A/C system with refrigerant (liquid or vapor); perform

leak test.

4. Inspect and correct oil level in A/C system.
5. Inspect, adjust, and replace A/C compressor drive belts; check pulley alignment.
6. Remove and replace A/C compressor; inspect, repair or replace A/C compressor mountings.
7. Inspect, repair or replace A/C system mufflers, hoses, lines, fittings, and seals.
8. Inspect A/C condenser for air flow restrictions; clean and straighten fins.
9. Inspect, test, and replace A/C system condenser and mountings.
10. Inspect and replace receiver/drier or accumulator/drier.
11. Inspect, and replace evaporator.
12. Inspect and repair evaporator housing water drain.
13. Inspect, test, repair or replace heating, ventilating, and A/C vacuum components.
14. Inspect and repair A/C component wiring according to manufacturers' specifications.
15. Inspect, test, and repair heating, ventilating, and A/C ducts, doors, hoses, and outlets.
16. Performance test heating and A/C system.

e. Drive Train

1. Remove and replace powertrain assembly; inspect, replace, and align powertrain mounts.
2. Remove, replace, and adjust cables or linkages for throttle valve (TV), kickdown, and accelerator pedal.
3. Remove and replace electronic sensors, wires, and connectors.
4. Remove, replace and adjust mechanical or hydraulic shift or clutch linkage as required.
5. Remove and replace front and/or rear drive axle assembly.
6. Remove, inspect, and replace front-drive shafts and axle constant velocity (CV) joints.
7. Inspect, remove, and replace front and rear drive shafts and universal joints.

f. Restraint Systems

1. Supplemental restraint systems (SRS)
   a. Disarm airbag system in accordance with manufacturers' procedures.
   b. Inspect and replace sensors and

wiring in accordance with manufacturers' procedures; insure proper sensor orientation.

c. Inspect, replace, and dispose of deployed airbag modules in accordance with manufacturers' procedures.

d. Verify that system is armed and operational in accordance with manufacturers' procedures.

e. Inspect, remove, replace, and dispose of non-deployed airbag in accordance with manufacturers' procedures.

f. Use fault codes to diagnose and repair airbag system.

5. Damage Analysis and Estimating (Test B6)

a. Damage Analysis

1. Position the vehicle for inspection.
2. Prepare vehicle for inspection by providing access to damaged areas.
3. Analyze damage to determine appropriate methods for overall repairs.
4. Determine the direction, point of impact, and extent of direct and indirect damage.
5. Identify and record pre-existing damage.
6. Determine the cost effectiveness of the repair and determine the approximate vehicle retail, salvage and repair value.
7. Perform visual inspection of structural components and members; determine if repair ore replacement is required.
8. Identify structural damage using measuring tools and equipment.
9. Perform visual inspection of non-structural components and members; determine if repair or replacement is required.
10. Determine parts and components necessary for proper repair.
11. Identify type and condition of finish; determine if refinishing is required.
12. Identify suspension, electrical, and mechanical component damage.
13. Identify safety systems damage and related service requirements.
14. Identify interior component damage.
15. Identify damage to add-on accessories and modifications.

b. Estimating

1. Determine and record customer/client and insurance information.
2. Identify vehicle identification number (VIN), make, model, year, production

date, body style, trim level, paint code, engine, transmissions, mileage, and license plate information.

3. Identify options, condition, accessories, modifications, and safety systems.
4. Apply appropriate parts nomenclature (terminology).
5. Determine and apply appropriate estimating sequence.
6. Utilize estimating guide procedure pages.
7. Apply estimating guide footnotes and headnotes as needed.
8. Estimate labor value for operation requiring judgement.
9. Select correct labor value for vehicle year, make, model body style, and options for each operation.
10. Select and price OEM parts.
11. Select and price non-OEM parts; verify availability.
12. Select and price salvage (used) parts; verify availability and condition.
13. Select and price remanufactured, rebuilt and reconditioned parts; verify availability.
14. Determine price and source of necessary sublet operations.
15. Determine labor value, prices, charges, allowances, or fees for non-included operation and miscellaneous items.
16. Recognize and apply overlap deduction, included operations, and additions.
17. Determine additional material and charges.
18. Determine refinishing material charges.
19. Select correct refinish labor value, remove overlap, and apply additions.
20. Determine sectioning procedures where appropriate and establish labor values.
21. Identify repair process for structural areas and establish labor values.
22. Determine structural measurement requirements; diagnose, and establish labor values.
23. Determine necessary structural straightening equipment, setup procedures, and establish labor values.
24. Apply math skills to establish charges and totals.
25. Interpret computer-assisted and manually written estimate; verify the system has current information.
26. Identify procedural differences between major computer assisted and manually

written estimating systems.
27. Identify procedures to establish corrosion protection and establish labor values.
28. Determine appropriate application of betterment/depreciation to parts and allowances as necessary.

c. Legal and Environmental Practices
1. Recognize regulatory obligations.
2. Recognize contractual and warranty obligations.
3. Recognize the repairer’s legal obligations to restore the vehicle to pre-loss condition based on established industry standards and vehicle manufacturer’s recommendations.
4. Apply proper business practices.

d. Vehicle Construction
1. Determine repairability of impact energy absorbing components.
2. Identify steel vehicle components and repair procedures.
3. Identify aluminum vehicle components and repair procedures.
4. Identify plastic components and repair procedures.
5. Identify vehicle glass components and repair procedures.
6. Identify add-on accessories and modifications.

e. Vehicle Systems Knowledge
1. Fuel, intake, ignition, and exhaust systems
   a. Identify major components.
   b. Identify component function.
   c. Identify OEM component service requirements.
2. Suspension, steering, and powertrain
   a. Identify OEM component service requirements.
3. Brakes
   a. Identify OEM component service requirements.
4. Heating, cooling, and air conditioning
   a. Identify major components.
   b. Identify component function.
   c. Identify OEM component service requirements.
5. Electrical/electronic systems
   a. Identify major components.
   b. Identify component function.
   c. Identify OEM component service requirements.

f. Parts Identification and Source

1. New original equipment manufacturer (OEM)
    a. Identify components.
    b. Identify component function.
    c. Justify repair or replace decision.
    d. Recognize proper application and use of chemicals.

IV. CONTENT:

A. Introduction/Safety
    1. Personal safety and health protection
    2. Safe use and care of tools
    3. Hazardous materials
    4. Respirator program

B. Welding
    1. Welding overview
    2. Aluminum welding
    3. Types of welds

C. Frame Repair
    1. Diagnosing frame damage
    2. Measuring vehicle damage
    3. Advanced body/frame measuring equipment
    4. Frame/uni-body straightening

D. Fillers and Plastic Repair
    1. Repairing sheet-molded compound panels
    2. Hot-air welding/repairing
    3. Adhesive repairs systems
    4. Heat and reshaping plastic parts

E. Electronic and electrical components
    1. Electrical safety
    2. Electrical terminology
    3. Diagnostic equipment
    4. Symbols
    5. Components

F. Pre-Painting Preparation
    1. Safety and health problems
    2. Shop and equipment preparation
    3. Preparing the surface

G. Refinishing Materials
    1. Thinners and reducers
    2. Topcoat additives
    3. Color and types of paint
    4. Masking

H. Refinishing the Vehicle
    1. Types of refinishing systems
    2. Applying the paint film
    3. Color matching fundamentals and techniques
    4. Refinishing plastic parts
    5. Identifying paint codes

I. Detailing
    1. Color sanding
    2. Refinishing defects
    3. Buffing fresh paint
    4. Striping tape
    5. Adhesive-backed moldings

J. Estimating
   1. Introduction to damage report writing
   2. Estimating labor and parts costs
   3. Assessing damage
   4. Estimating refinishing cost

K. Custom Painting
   1. Types of paints
   2. Sanding materials and methods
   3. Clear coats
   4. Pearls
   5. Decals
   6. Tinting
   7. Paint problems
   8. General up-keep

V. METHODS OF INSTRUCTION:

The methods of instruction include but are not limited to:

A. Lecture and direct laboratory demonstration by instructor
B. Multi-media instruction
C. Guided laboratory practice by the learner
D. Group participation

VI. TYPICAL ASSIGNMENTS:

A. Read assigned chapters and answer questions at the end of each chapter.
   Typical Question:
   List safety precautions taken during welding.
B. Name and perform six (6) MIG welding techniques.
C. Identify all ten (10) sections on a material safety data sheet.
D. List eleven (11) basic safety rules for pulling out body/frame damage.
E. Inspect , test, and replace fusible links, circuit breakers, and fuses.

VII. EVALUATION:

A. Methods of Evaluation:
   1. Graded assignments
   2. Graded tests
   3. Major lab project
   4. Final exam
B. Frequency of Evaluation:
   1. Twenty-five (25) assignments
   2. One (1) project
   3. Test at the end of each section
   4. One (1) final exam

VIII. TYPICAL TEXT(s):

| | |
|---|---|
| Title: | I-CAR Collision Repair |
| Author: | James Duffy |
| Publisher: | Delmar Publishers |
| Date of Publication: | 1996 |

| | |
|---|---|
| Title: | Principles of Auto Body Repair and Refinishing, 6th Edition |
| Author: | Deroche & Hildebrand |
| Publisher: | Prentice Hall |
| Date of Publication: | 1996 |

| | |
|---|---|
| Title: | Motor Auto Body Repair, Third Edition |
| Author: | Robert Scharff/James Duffy |
| Publisher: | Delmar Publishers |
| Date of Publication: | 1998 |

IX. OTHER SUPPLIES REQUIRED OF STUDENTS: Project supplies and dual cartridge respirator

Last updated: 10/98

**Step 3, Form A**

**Content Review Form**
**PREREQUISITE COURSE**

**Target Course:** AUTO 048#3 Intermediate Automotive Collision Repair & Refinishing

**Prerequisite Course:** AUTO 039#3 Secondary Automotive Collision Repair & Refinishing

**Instructions:**

List exit competencies (skills) from Prerequisite Course. These skills are listed in the "Student Outcomes" section of the Course Outline ("upon completion of the course, the student should be able to…")

Indicate which of the listed exit competencies (skills) are necessary entry skills needed for success in the target course. Mark with an "X" each needed skill.

Indicate the degree of importance of each needed entry skill for course success, using the following rating scale:

1=Critical 2=Very Helpful 3=Desirable

**Skills Analysis**

| | Exit Skills in Prerequisite Course | Entry Skills Needed for Success in Target Course (Mark with an X if needed.) | Degree of Importance (Rate 1 – 3) |
|---|---|---|---|
| 1. | Explain how to avoid shop accidents. | X | 1 |
| 2. | Outline the control measures needed when working with hazardous substances. | X | 1 |
| 3. | Summarize hand and power tool safety. | X | 1 |
| 4. | Identify and operate MIG/spot welder using HSS parts. | X<br>X | 1<br>1 |
| 5. | Describe and perform basic straightening and alignment techniques. | X | 1 |
| 6. | Choose the correct anti-corrosion materials and equipment. | X | 1 |
| 7. | Perform service on automotive hardware, doors, glass and identify service products and equipment. | X | 1 |
| 8. | Explain the difference between spot refinishing panel refinishing, and overall refinishing. | X | 1 |
| 9. | Adjust a spray gun to prepare for painting. | X | 1 |
| 10. | Identify gun handling problems. | X | 1 |
| 11. | Perform two part adhesive repairs. | X | 1 |
| 12. | List the types of suspension design. | X | 1 |
| 13. | Identify components and terminology of Genesis. | X | 1 |
| 14. | List and explain the functions of the three types of undercoats. | X | 1 |
| 15. | Identify/describe a required respirator program. | X | 1 |
| 16. | Have the knowledge and skills to pass the Automotive Service Excellence (ASE) National Test. | | |