

OBJECTIVE SYLLABUS FOR AUTOMOTIVE SURFACE FINISHING

SECTION A - WHY SURFACE FINISHING?

Lesson 1 - Surface Finishing Techniques and Applications

At the end of Lesson 1, you should be able to:

- 1.1 Define surface finishing.
- 1.2 Describe the main processes used for Surface Finishing and their basic principles.
- 1.3 Describe the purposes for which these finishes are applied to substrates.
- 1.4 Describe the nature of the Surface Finishing Industry and its economic importance.

Lesson 2 - Properties of Different Surface Finishes

At the end of Lesson 2, you should be able to:

- 2.1 List the strengths and weaknesses of various surface finishes.
- 2.2 Decide which finish is appropriate for a particular function.

SECTION B- BASIC SCIENCE FOR COATINGS

Lesson 3 - Chemical Symbols and Chemical Equations

At the end of Lesson 3, you should be able to:

- 3.1 Write the chemical symbols for the chemicals used most often in surface finishing.
- 3.2 Write chemical equations for simple chemical reactions.
- 3.3 Understand how atoms join together by ionic and covalent bonds.

Lesson 4 - How Coatings Can Prevent Corrosion

At the end of lesson 4 you should be able to:

- 4.1 Define corrosion and understand its consequences.
- 4.2 Understand the chemistry of corrosion of iron.
- 4.3 Understand the electrochemical nature of the aqueous corrosion of metals.
- 4.4 Know how the electrochemical series can be used to select coatings for the prevention of corrosion.
- 4.5 Understand how coatings prevent corrosion.
- 4.6 Describe the need for accelerated corrosion tests for coated products and explain the main tests.

Lesson 5 - Calculating thicknesses, areas and volumes

At the end of Lesson 5, you should be able to:

- 5.1 Calculate area and volumes.
- 5.2 Calculate the coverage of paint and coating powders.
- 5.3 Calculate the cost of the paint or coating powder per component.

Lesson 6 - Adhesion

At the end of Lesson 6, you should be able to:

- 6.1 Discuss some basic theories of adhesion that apply to powder coatings.
- 6.2 Discuss some of the problems which occur at a substrate/coating interface.
- 6.3 Assess the effectiveness of different cleaning treatments.

SECTION C - ORGANIC COATINGS

Lesson 7 - Introducing Paints, Lacquers, Varnishes and Coating powders

At the end of Lesson 7 you should be able to:

- 7.1 Appreciate how chemistry relates to coating technology.
- 7.2 Understand the roles of polymers, pigments and solvents.
Understand the principles of coating formulation.
- 7.3 Name the most common polymer resins used in liquid coating formulations.
- 7.4 Explain how the structure of different polymers imparts different properties to the coating.
- 7.5 Learn about coating powders.

Lesson 8 - Aspects of Formulation of Organic Coatings

At the end of Lesson 8 you should be able to:

- 8.1 Understand the principles of coating formulation.
- 8.2 Name the most common polymer resins used in liquid coating formulations.
- 8.3 Appreciate how paints are manufactured and thus understand their behaviour.
- 8.4 Be knowledgeable about the properties of coating materials.

Lesson 9 - The Nature of Automotive Finishes

At the end of Lesson 9 you should be able to:

- 9.1 Appreciate the development and important role of automotive primers.
- 9.2 Understand the critical aspects of surfacers and anti-chip coatings, particularly as VOC legislation becomes an issue.

- 9.3 Learn about different types of base coats and consider the possible future development of new materials.
- 9.4 Appreciate the development and use of clearcoats in basecoat clear systems. Anticipate any future role for coating powders in automotive plants.
- 9.5 Have a basic understanding of the testing that may be required to ascertain the suitability of coating systems for automotive use.

SECTION D - PREPARATION OF SUBSTRATES

Lesson 10 - Substrates and Their Cleaning

At the end of Lesson 10 you should be able to:

- 10.1 Appreciate the development and important role of automotive primers.
- 10.2 Understand the vital importance of surface preparation, including cleanliness and surface roughness.
- 10.3 Discuss methods of mechanical cleaning for substrate preparation.
- 10.4 Discuss the advantages and disadvantages of using solvents for cleaning.
- 10.5 Discuss methods of using water based systems for cleaning surfaces.
- 10.6 Understand the reasons for handling components for coating applications with due care.

Lesson 11 - Pretreatment with Chemical Conversion Coatings

At the end of Lesson 11, you should be able to:

- 11.1 Define the purposes of conversion coatings.
- 11.2 Discuss the chemistry of phosphating on steel.
- 11.3 Discuss the different types of phosphate coatings, explain their uses and be able to select the right one for products under different environmental conditions of use.
- 11.4 Describe the layout of a typical phosphating plant.
- 11.5 Discuss the use of chromate conversion coatings on different metals.
- 11.6 Know that safer alternatives to phosphating and chromating solutions are now available

SECTION E - PREPARATION FOR PAINTING

Lesson 12 - Working with Paints, Lacquers and Varnishes

At the end of Lesson 12 you should be able to:

- 12.1 Explain the practical precautions to be taken when working with coating materials
- 12.2 Understand the initial preparation of the coating material prior to application.
- 12.3 Discuss the initial testing necessary to ensure that the coating material is suitable for application.
- 12.4 Carry out standard tests to establish application criteria and parameters.

SECTION F - APPLICATION OF COATINGS

Lesson 13 - Application of Paints, Lacquers and Varnishes by Non-Atomisation Techniques

At the end of Lesson 13 you should be able to:

- 13.1 Have an understanding of the basic processes of coating application.
- 13.2 Know the decisions that are made to select the correct process.
- 13.3 Describe techniques for coating small components such as fasteners.
- 13.4 Know the advantages and disadvantages of the various dipping techniques.
- 13.5 Describe automated processes for coating high volumes of simple shapes.

Lesson 14 - Deposition of electrophoretic and autophoretic coatings

At the end of Lesson 14 you should be able to:

- 14.1 Explain the electrophoretic coating process.
- 14.2 Understand the difference between anodic and cathodic deposition.
- 14.3 Explain the autophoretic coating process.
- 14.4 Give the advantages and disadvantages of electrophoretic and autophoretic processes.

Lesson 15 - Spray Application Processes

At the end of Lesson 15 you should be able to:

- 15.1 Describe conventional spray application and know its limitations.
- 15.2 Review the decisions that are made to select air atomising equipment and appreciate their function use and control.
- 15.3 Understand the environmental benefits of HVLP and airless spraying techniques.
- 15.4 Have an understanding of hydraulic atomisation and its variants including air assisted airless techniques.
- 15.5 Know the benefits of 'hot spray' techniques.
- 15.6 Understand the practical use of spray application devices.

Lesson 16 - Electrostatic and Automated Application Processes

At the end of Lesson 16 you should be able to:

- 16.1 Appreciate the benefits of electrostatic process for the application of paint.
- 16.2 Understand the principles of electrostatic application.
- 16.3 Study and compare the various designs of electrostatic paint application equipment.
- 16.4 List and relate the important variable parameters for equipment set-up that provide the quality and efficiency of this coating application method.
- 16.5 List and relate the important variable coating parameters that provide the quality and efficiency of this coating application method.
- 16.6 Discuss the benefits of gun movers, reciprocators/manipulators and robots.

Lesson 17 - Application of Powder Coatings

At the end of Lesson 17 you should be able to:

- 17.1 Describe the fluidised bed technique.
- 17.2 Describe the electrostatic spraying technique.
- 17.3 Discuss the charging of powders by the corona charging techniques.
- 17.4 Discuss the charging of powders by the tribo charging technique.
- 17.5 Describe powder feeding systems.

SECTION G - PLANT AND EQUIPMENT

Lesson 18 - Transporting Coating Materials

At the end of Lesson 18 you should be able to:

- 18.1 Appreciate the necessity to handle coating materials with care.
- 18.2 Review the various methods for feeding liquid materials to applicators.
- 18.3 Understand the operation of pumps.
- 18.4 Have a basic understanding of paint circulation systems.
- 18.5 Review the options for colour change
- 18.6 Understand the complexities of plural component systems.
- 18.7 Have a basic understanding of coating powder handling
- 18.8 Describes systems for recovering oversprayed powder.

Lesson 19 - Air movement, Drying and Curing

At the end of Lesson 19, you should be able to:

- 19.1 Understand the importance of air movement in the coating application process.
- 19.2 Review the operational facilities provided by spray booths and flash off areas.
- 19.3 Consider the process of overspray removal.
- 19.4 Explain the differences between drying and curing.
- 19.5 Review various types of oven.
- 19.6 Explain the process of infra red curing.
- 19.7 Understand the benefits of new curing technologies.
- 19.8 Discuss the essential features for curing coating powders.
- 19.9 Review the important design features of heating and curing equipment.

Lesson 20 - Ancillary Operations

At the end of Lesson 20, you should be able to:

- 20.1 Know the importance of good design of jigs and fixtures.
- 20.2 Describe different methods for the stripping of coatings.
- 20.3 Know the advantages and disadvantages of different coating stripping techniques.
- 20.4 Understand the need for masking parts of components when coating.

SECTION H - SERVICES

Lesson 21 - Water Chemistry, Utilities and Prime Services

At the end of Lesson 21 you should be able to:

- 21.1 Appreciate the meaning and purpose of utilities and prime services in the Paint Shop.
- 21.2 Realise the importance of water and know what it is.
- 21.3 Be aware of the properties of water.
- 21.4 Know about the treatment of water.
- 21.5 Be aware of the quality of deionised water.
- 21.6 Appreciate the value of water as a heat transfer fluid for cooling and heating.
- 21.7 Understand the key properties of utilities and services.
- 21.8 Be knowledgeable of the Factory Coding System.

SECTION I - CONTROLLING THE PRODUCT AND THE PROCESS

Lesson 22 - Testing of Coatings

At the end of Lesson 22 you should be able to:

- 22.1 Describe standard methods of ensuring that coatings meet quality standards.
- 22.2 Review test methods for assessing the visual properties of coatings.
- 22.3 Review test methods for assessing the mechanical properties of coatings.
- 22.4 Review test methods for assessing the environmental performance of coatings.
- 22.5 Understand the limitations of accelerated corrosion tests.

Lesson 23 - Troubleshooting Coating Defects and Process Control

At the end of Lesson 23, you should be able to:

- 23.1 Know how to identify the most common causes of problems.
- 23.2 Know how to inspect coatings.
- 23.3 Know how to troubleshoot.
- 23.4 Appreciate the benefits of process control.
- 23.5 Know how to use control charts.
- 23.6 Know about failure mode analysis.

SECTION J - HEALTH, SAFETY AND ENVIRONMENTAL ISSUES IN SURFACE FINISHING

Lesson 24 – Health, Safety and Environmental Legislation

At the end of Lesson 24, you should be able to:

- 24.1 Understand what is required of an employer under the Health & Safety at Work Act (1974).
- 24.2 Understand what is required of an employee under the Health & Safety at Work Act (1974).
- 24.3 Be aware of the requirements of Control of Substances Hazardous to Health (COSHH).
- 24.4 Understand the need for risk assessments and their relevance to COSHH and the Health and Safety at Work Act.
- 24.5 Be aware of the use and meanings of Risk and Safety phrases.
- 24.6 Be aware of REACH.
- 24.7 Understand the role of the Environmental Protection Act and how it relates to surface finishing.
- 24.8 Be aware of other legislation that may affect the processes used in surface finishing.

Lesson 25 – Health and Safety Hazards and Precautions

At the end of Lesson 25, you should be able to:

- 25.1 List and identify the most important items of safety equipment in a surface finishing department.
- 25.2 Identify the most common hazards to be found in the workplace.
- 25.3 Be aware of specialist hazards to be found in different type of surface finishing areas.
- 25.4 Know how to avoid any short and long term effects of these hazards.
- 25.5 Know how to avoid a fire and to mitigate its effects.
- 25.6 Discuss the importance and role of training in the prevention of accidents.
- 25.7 Be aware of the hazards in the painting environment.
- 25.8 Know how to design plant and equipment for painting to reduce the risk of accidents.

Lesson 26 – The Treatment and Disposal of Finishing Wastes

At the end of Lesson 26, you should be able to:

- 26.1 Discuss how the discharge of hazardous effluents can cause danger, damage or loss.
- 26.2 List the main hazardous wastes from Surface Finishing.
- 26.3 Explain how heavy metal ions can be removed by alkaline precipitation and flocculation.
- 26.4 Discuss how to minimise the amounts of waste produced.
- 26.5 Discuss methods for reducing water usage.
- 26.6 Identify how energy is wasted.