

OBJECTIVE SYLLABUS FOR PAINT, LACQUER AND VARNISH MODULE

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 - INTRODUCTION TO PAINTS, LACQUERS AND VARNISHES

Lesson 7 - The Composition of Paints Lacquers and Varnishes

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

- 7.1 Define paint, lacquer or varnish.
- 7.2 List the basic constituents of liquid coatings.
- 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 Understand the role of pigments.
- 7.6 Understand the contribution of solvents and diluents in making coating materials suitable for application.

SECTION D - PREPARATION FOR PAINTING

Lesson 8 - Substrates and Their Cleaning

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

- 8.1 Understand why cleaning of the substrate is important.
- 8.2 Discuss the advantages and disadvantages of using solvents for cleaning.
- 8.3 Discuss methods of using water based systems for cleaning surfaces.
- 8.4 Discuss mechanical methods of cleaning.

Lesson 9 - Pretreatment with Chemical Conversion Coatings

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

- 9.1 Define the purposes of conversion coatings.
- 9.2 Discuss the chemistry of phosphating on steel.
- 9.3 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.
- 9.4 Describe the layout of a typical phosphating plant.
- 9.5 Discuss the use of chromate conversion coatings on different metals.
- 9.6 Know that safer alternatives to phosphating and chromating solutions are now available

Lesson 10 - Working with Paints, Lacquers and Varnishes

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

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

SECTION E - APPLICATION OF PAINTS, LACQUERS AND VARNISHES

Lesson 11 - Atomising Techniques for Applying Paints, Lacquers and Varnishes

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

- 11.1 Know the criteria for selecting the coating technique.
- 11.2 Understand the importance of transfer efficiency.
- 11.3 List the different techniques for applying paints, lacquers and varnishes.
- 11.4 Describe conventional spray application and know its limitations.
- 11.5 Understand the benefits of HVLP and airless spraying techniques.
- 11.6 Know the benefits of 'hot spray' techniques
- 11.7 Describe a typical electrostatic spraying process.
- 11.8 Know the benefits of electrostatic spraying.

Lesson 12 - Application of Paints, Lacquers and Varnishes by Non-Atomisation Techniques

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

- 12.1 List the different non-atomisation application techniques.
- 12.2 Describe techniques for coating small components such as fasteners.

- 12.3 Know the advantages and disadvantages of the various dipping techniques.
- 12.4 Describe automated processes for coating high volumes of simple shapes.

Lesson 13 - Deposition of electrophoretic and autophoretic coatings

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

- 13.1 Explain the electrophoretic coating process.
- 13.2 Understand the difference between anodic and cathodic deposition.
- 13.3 Explain the autophoretic coating process.
- 13.4 Give the advantages and disadvantages of electrophoretic and autophoretic processes.

Lesson 14 - Speciality coatings

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

- 14.1 Explain how photoresists work.
- 14.2 Understand intumescent and thermal barrier coatings.
- 14.3 Describe the benefits and applications of metal loaded paints.
- 14.4 Discuss the benefits of antifouling paints.
- 14.5 Discuss the advantages of the duplex coating system of galvanised steel plus paint.

SECTION F - PLANT AND EQUIPMENT

Lesson 15 - Drying and Curing

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

- 15.1 Explain the differences between drying and curing.
- 15.2 Review various types of oven.
- 15.3 Explain the process of infrared curing.
- 15.4 Understand new radiation curing technologies.

Lesson 16 - Transporting Coating Materials

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

- 16.1 Appreciate the necessity to handle coating materials with care.
- 16.2 Review the various methods for feeding liquid materials to applicators.
- 16.3 Have a basic understanding of paint circulation systems.
- 16.4 Understand the importance of air movement in the coating application process.
- 16.5 Review the operational facilities provided by spray booths and flash-off areas.
- 16.6 Have an understanding of the process for overspray capture and removal.

Lesson 17 - Ancillary Operations

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

- 17.1 Know the importance of good design of jigs and fixtures.
- 17.2 Describe different methods for the stripping of coatings.
- 17.3 Know the advantages and disadvantages of different coating stripping techniques.
- 17.4 Understand the need for masking parts of components when coating.
- 17.5 Understand the benefits of automation and robots for spraying operations.

SECTION G - SERVICES

Lesson 18 - Water Chemistry, Utilities and Prime Services

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

- 18.1 Appreciate the meaning and purpose of utilities and prime services in the Paint Shop.
- 18.2 Realise the importance of water and know what it is.
- 18.3 Be aware of the properties of water.
- 18.4 Know about the treatment of water.
- 18.5 Be aware of the quality of deionised water.
- 18.6 Appreciate the value of water as a heat transfer fluid for cooling and heating.
- 18.7 Understand the key properties of utilities and services.
- 18.8 Be knowledgeable of the Factory Coding System.

SECTION H - CONTROLLING THE PRODUCT AND THE PROCESS

Lesson 19 - Testing of Coatings

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

- 19.1 Describe standard methods of ensuring that coatings meet quality standards.
- 19.2 Review test methods for assessing the visual properties of coatings.
- 19.3 Review test methods for assessing the mechanical properties of coatings.
- 19.4 Review test methods for assessing the environmental performance of coatings.
- 19.5 Understand the limitations of accelerated corrosion tests.

Lesson 20 - Troubleshooting Coating Defects and Process Control

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

- 20.1 Know how to identify the most common causes of problems.
- 20.2 Know how to inspect coatings.
- 20.3 Know how to troubleshoot.
- 20.4 Appreciate the benefits of process control.
- 20.5 Know how to use control charts.
- 20.6 Know about failure mode analysis.

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

Lesson 21 – Health, Safety and Environmental Legislation

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

- 21.1 Understand what is required of an employer under the Health & Safety at Work Act (1974).
- 21.2 Understand what is required of an employee under the Health & Safety at Work Act (1974).
- 21.3 Be aware of the requirements of Control of Substances Hazardous to Health (COSHH).
- 21.4 Understand the need for risk assessments and their relevance to COSHH and the Health and Safety at Work Act.
- 21.5 Be aware of the use and meanings of Risk and Safety phrases.
- 21.6 Be aware of REACH.
- 21.7 Understand the role of the Environmental Protection Act and how it relates to surface finishing.
- 21.8 Be aware of other legislation that may affect the processes used in surface finishing.

Lesson 22 – Health and Safety Hazards and Precautions

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

- 22.1 List and identify the most important items of safety equipment in a surface finishing department.
- 22.2 Identify the most common hazards to be found in the workplace.
- 22.3 Be aware of specialist hazards to be found in different type of surface finishing areas.
- 22.4 Know how to avoid any short and long term effects of these hazards.
- 22.5 Know how to avoid a fire and to mitigate its effects.
- 22.6 Discuss the importance and role of training in the prevention of accidents.
- 22.7 Be aware of the hazards in the painting environment.
- 22.8 Know how to design plant and equipment for painting to reduce the risk of accidents.

Lesson 23 – The Treatment and Disposal of Finishing Wastes

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

- 23.1 Discuss how the discharge of hazardous effluents can cause danger, damage or loss.
- 23.2 List the main hazardous wastes from Surface Finishing.
- 23.3 Explain how heavy metal ions can be removed by alkaline precipitation and flocculation.
- 23.4 Discuss how to minimise the amounts of waste produced.
- 23.5 Discuss methods for reducing water usage.
- 23.6 Identify how energy is wasted.