Qualifications

Diploma in Packaging

Module 3

Examination Syllabus 2021

Unit 1: Resource Management

Topic	Candidates should understand and be able to demonstrate using detailed examples:

Environment and Sustainability	• Sustainability and climate change
	• Energy conservation
	  ○ principle energy consuming activities
	  ○ energy reduction strategies
	• Water conservation
	  ○ purpose for water in packaging operations
	  ○ water conservation strategies
	• Waste minimisation
	  ○ packaging waste

Health and safety	• Fundamental considerations
	  ○ health and safety in the food and drink industry
	  ○ relevant national and local legislation and regulations
	  ○ principle of duty of care
	• Management
	  ○ organisational structure and responsibilities regarding health and safety
	  ○ measuring and reviewing performance and training
	• Understanding of workplace hazards and precautions
	  ○ techniques for assessing hazards and risks
	  ○ safe working practices
	  ○ accident investigation and reporting

Maintenance	• Aims of maintenance
	• Approaches to maintenance
	• Maintenance tasks
	  ○ types and variety of maintenance tasks in packaging
	• Organisation
	  ○ planning of maintenance activities

Unit 2: Fluid Mechanics

Topic	Candidates should understand and be able to demonstrate using detailed examples:

Principles of fluid mechanics	• Forms of fluid and fluid energy
	• Properties of moving fluids
	• Friction loss
	• Pumps
	  ○ centrifugal pumps
	  ○ positive displacement pumps
	  ○ cavitation and net positive suction head (NPSH)
	• Valves
	  ○ design features and merits of different types of valves

Unit 3: Gases

Topic	Candidates should understand and be able to demonstrate using detailed examples:

Gases	• Gases used and typical applications
	• Gas laws
	  ○ equations relating to pressure, temperature, volume, and density using the perfect gas laws
	  ○ universal gas law and gas constant
	• Dalton's law of partial pressures
	• Gas solubility
	• Henry's law and the concept of gas/liquid equilibrium
	  ○ gas/liquid solubility and temperature
	  ○ effects of hydrostatic head
	  ○ saturation and supersaturation
	• Gas dissolution
	  ○ principles of dissolving gases in liquids
	  ○ typical equipment for measurement and control
	  ○ effects of temperature and pressure on carbonation levels in carbonated drinks
	• Handling fluids supersaturated in CO_2
	  ○ overcoming influences of high temp and low pressure

Unit 4: Heat Transfer

Topic	Candidates should understand and be able to demonstrate using detailed examples:

Principles of heat transfer	• Forms of heat energy
	  ○ definition of specific heat
	  ○ latent heat and exothermic heat
	  ○ calculations of energy change
	• Heat transfer mechanisms
	  ○ conduction, convection, and radiation
	  ○ steady and unsteady heat transfer
	  ○ calculation of the overall heat transfer coefficient
	  ○ effects of fouling and scaling
	• Insulation
	  ○ function of insulation

Heat transfer technology	• Heat exchanger sizing
	  ○ concept of the heat balance and heat transfer across a temperature gradient
	  ○ co-current and counter-current flow in a heat exchanger
	• Plate heat exchanger
	  ○ design, construction, components, and configuration
	  ○ importance of fouling/scaling problems
	  ○ heat exchanger calculations
	  ○ applications in packaging
	• Shell and tube heat exchangers
	  ○ design, construction, components, and configuration
	  ○ heat exchanger calculations
	  ○ applications in packaging
	• Jacketed vessels
	  ○ design, construction, components, and configuration
	  ○ heat exchanger calculations
	  ○ applications in packaging

Unit 5: Utilities Part 1 (Steam and Refrigeration)

Topic	Candidates should understand and be able to demonstrate using detailed examples:

Steam	• Reasons for using steam
	• Steam properties
	  ○ temperature-energy relationship as illustrated in the Mollier chart
	  ○ steam tables
	  ○ specific heat of liquid water
	  ○ latent heat of vaporisation
	  ○ concept of steam quality

	• Steam raising and distribution
	  ○ boiler design
	  ○ pipe sizes, arrangements, and design velocities
	  ○ insulation
	  ○ steam traps
	  ○ control valves, reducing vales and relief valves
	  ○ legal requirements in having a properly designed, safe system with the correct protection measures
	• Principal steam applications

Refrigeration	• Refrigeration theory
	  ○ definition of refrigeration
	  ○ concept of pressure/temperature equilibrium in relation to the vapour compression refrigeration process
	  ○ refrigeration cycle
	  ○ function of the evaporator, compressor, condenser, and expansion valve

	• Refrigeration systems
	  ○ compressors
	  i. reciprocating vs screw
	  ii. single versus multistage
	  ○ condensers
	  ○ evaporators
	• Primary refrigerants
	  ○ purpose and choice
	  ○ physical and chemical properties
	  ○ safety and environmental concerns
	• Secondary refrigerants
	  ○ purpose and choice
	  ○ chemical properties
	  ○ safety and environmental concerns
	• Refrigeration applications
	  ○ reasons for use

Unit 6: Utilities Part 2

Topic	Candidates should understand and be able to demonstrate using detailed examples:
Water	• Different types of water and their uses (focusing on process and service water) • Service water treatment
Effluent	• Effluent treatment
Electricity	• The basic elements of electricity • Types of current used in the packaging facility • Electrical safety control measures • Soft starter or variable speed drive selection factors

Gases	• Compressed air
	  ○ common systems for compressed air production
	  ○ components of air distribution systems
	  ○ quality requirements for packaging operations
	• Nitrogen
	  ○ specifications
	  ○ supply, storage, and vaporisation
	  ○ applications
	• Carbon Dioxide
	  ○ liquid CO_2 storage and vaporisation methods

Unit 7: Process Control and Instrumentation

Topic	Candidates should understand and be able to demonstrate using detailed examples:

Process control	• Basic control elements
	  ○ sensors, controllers, and actuators
	• Basic on/off control
	  ○ timers, thermostats, pressure switches, proximity switches, and others
	• Sequence control
	  ○ description of programmable logic controller (PLC)
	  ○ examples of plc applications
	• Aim of process control
	• Principles of process control
	• Control arrangements
	• Typical control systems
	• Actuation
	• Control system arrangements
	  ○ self-actuating controllers
	  ○ individual electronic analogue controls
	  ○ small local computer control
	• Supervisory Control and Data Acquisition (SCADA),
	• Management Information Systems (MIS) and other large digital systems
	• Comparative costs
	• Robotics systems used in packaging

Instrumentation	• Factors determining the choice of sensors
	• Typical conventional sensors
	  ○ including pressure, volume flow, temperature, mass flow level and vessel contents
	• Typical analytical sensors
	  ○ including CO_2, O_2, optical devices, pH, density, and alcohol content

Unit 8: Materials of Construction

Topic	Candidates should understand and be able to demonstrate using detailed examples:
Classification and properties	• Carbon and low alloy steels • Stainless steels • Other metals including copper (and alloys), aluminium and cast iron • Plastics and glass • Civils finishes • Corrosion
Applications and limitations	• Advantages and disadvantages • Applications
Hygienic design	• Principles of hygienic design • Requirements for hygienic design with regards to material, equipment, and installation • Understanding the role of hygiene organisations and how to utilise them