Diploma in Distilling

Module 3 Syllabus

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UNIT 1: RESOURCE MANAGEMENT

Candidates are required to have an in-depth understanding of the following:

Environmental Sustainability

1. Understand the global context for sustainable development.
2. Understand the key drivers of climate change, its impacts and mitigation opportunities.
3. Describe key environmental impacts of distilling that can be controlled or reduced; especially water and energy use and waste.
4. Describe the management techniques available to increase environmental sustainability of distillery operations such as water and energy use.
5. Identify opportunities for innovation that reduce environmental impact from distilling.

Health and Safety

1. Understand the types of health and safety legislation which may apply to a distillery, and the actions required by the owners, managers, and employees.
2. Understand how health and safety should be managed within an organisation.
3. Conduct risk assessments using various risk identification methods.
4. Describe the key hazards found in a distillery, including knowledge of dust, combustible liquids, and ammonia risk control.
5. Appreciate the importance of near miss and accident investigations.

Maintenance

1. Understand the goals and deliverables of a maintenance programme.
2. Describe the features, advantages, disadvantages, and applications of no maintenance, run to failure (RTF), preventative maintenance (PM), and predictive maintenance (PdM).
3. Explain the main elements required to successfully set up and run a maintenance programme and department.
4. Demonstrate a clear understanding of how maintenance is executed across distilling.
5. Compare the relationships between maintenance and safety, reliability, quality, economics, and environmental impact.
6. Understand the statutory (legal and legislative) maintenance requirements and obligations.
7. Recognise and explain the importance of partnering design and engineering to provide a robust, safe, and flexible distillery.

UNIT 2: FLUID MECHANICS

Candidates are required to have an in-depth understanding of the following:

Principles of Fluid Mechanics 1

1. Describe the concept of viscosity related to fluids.
2. Explain the difference between Newtonian and non-Newtonian fluids, as described by Newton's law of viscosity.
3. Solve static fluid problems to determine the value of pressure in practical situations and understand which parameters can influence the value of pressure.
4. Describe different types of pressure instrumentation.

Principles of Fluid Mechanics 2

1. Understand and be able to apply the concept of mass and energy conservation to pipe and duct flows.
2. Apply the concept of the Reynolds number to defining laminar, transitional, or turbulent pipe flows in circular and non-circular geometries.
3. Describe common fluids in the distillery context which are transported under laminar or turbulent flow conditions.

Principles of Fluid Mechanics 3

1. Describe the contribution and causes of frictional and fitting pressure losses to the pressure drop in a pipe or duct system.
2. Apply the Darcy-Weisbach equation and Moody diagram to quantify frictional pressure drop.
3. Apply the loss coefficient approach to quantify pressure losses due to pipe and duct fittings.
4. Specify typical design pipe and duct velocities and pressure drops.

Control of Fluid Flow 1

1. Describe the principle of operation of centrifugal and positive displacement pumps.
2. Recommend pump types for different distilling applications.
3. Discuss the various criteria used to define pump performance.
4. Describe the principle of matching centrifugal pump performance to a piping system requirement using the pump-curve approach and apply this principle to simple situations.
5. Describe the approaches of flow rate control and pump starting procedures.

Control of Fluid Flow 2

1. Describe the process of cavitation, including its causes and consequences for product quality and equipment integrity.
2. Compare and contrast the related concepts of available net positive suction head and required net positive suction head.
3. Apply the concept of net positive suction head to pump operation and system design to ensure that cavitation does not occur.

Control of Fluid Flow 3

1. Describe the difference between on-off and modulating flow control and give distilling examples.
2. Describe the concept of valve flow rate characteristic and explain why it is important for different aspects of flow control.
3. Discuss various valve types and their principle of operation.
4. Explain the concept of block and bleed and double-seat mixproof valves as a means of managing valve leakage.

UNIT 3: HEAT TRANSFER

Candidates are required to have an in-depth understanding of the following:

Principles of Heat Transfer and Conduction

1. Describe the different forms of heat energy.
2. Describe the different ways that heat energy can travel through matter.
3. Determine whether a material is a conductor or an insulator.
4. Explain how heat is transferred through a wall or pipe with or without insulation.

Convection

1. Describe the mechanism by which convective heat transfer occurs at a solid surface, between it and the fluid adjacent to it.
2. Define and explain the importance of the film heat transfer coefficient.
3. Describe and give examples of natural and forced convection.
4. Describe the mechanisms of boiling and condensation.

Radiation and Combined

1. Describe and provide examples of heat transfer by radiation.
2. Describe and provide examples of scenarios when multiple forms of heat transfer are combined.
3. Define and calculate the overall heat transfer coefficient for a combined heat transfer process.

Heat Exchangers

1. Describe the various heat exchangers used in producing spirits, their key components, and applications.
2. Demonstrate how the configuration of a heat exchanger influences the exchanger design and performance.
3. Explain, using the principles of heat transfer, how heat is transferred in a heat exchanger, and the factors affecting the rate of heat transfer.
4. Select and size the appropriate exchanger for an application in a distillery and explain the pros and cons of your selection.
5. Explain why the actual performance of an exchanger varies from design and how this can be managed in a distillery.

Jacketed Vessels

1. Describe the application of jacketed vessels along with their key components and functions.
2. Show how the configuration of a jacketed vessel influences its design and performance.
3. Using the principles of heat transfer, explain how heat is transferred in a jacketed vessel and the various factors affecting this.
4. Select and size a jacketed vessel for an application in a distillery; explain the pros and cons of your selection.
5. Explain why the actual performance of a jacketed vessel varies from its design specifications, and state how this can be managed in a distillery.

UNIT 4: UTILITIES PART 1 (STEAM AND REFRIGERATION)

Candidates are required to have an in-depth understanding of the following:

Steam Theory

1. Describe the benefits of using steam as a heating medium in a distillery.
2. Understand how to use a Mollier chart and steam tables.
3. Give definitions of, and describe the production methods of, both utility and culinary steam.

Steam Technology

1. Describe the operation of boilers.
2. Understand the importance of boiler safety.
3. Explain the function of the components that form part of a steam reticulation system.

Refrigeration Theory and Cycle

1. Understand the difference between cooling and attemperation, and describe where you can find examples of these processes in a distillery.
2. Explain and demonstrate the use of the refrigeration cycle.
3. Explain what a coefficient of performance is and describe its significance in the distillery.

Refrigeration Technology

1. Describe the operation of the equipment most commonly used in the primary refrigeration process.
2. Compare the required properties of common primary and secondary refrigerants.
3. Describe how refrigeration is used in the distillery.

UNIT 5: UTILITIES PART 2

Candidates are required to have an in-depth understanding of the following:

Water

1. Describe the different types of water used in the distillery.
2. Describe the operations within common water treatment processes.
3. Compare different water treatment processes.
4. Recommend water treatment options based on different sources and conditions.

Effluent Treatment

1. Compare aerobic and anaerobic effluent treatment systems.
2. Recommend effluent treatment technologies based on the requirements of a distillery.
3. Understand the Mogden formula
4. Recommend options for water reuse.

Electricity

1. Describe the basic elements of electricity.
2. Recommend where in the distillery to use DC and AC power as well as single-phase and three-phase power.
3. Explain the differences between earthing, grounding, and overload protection.
4. Recommend where to use soft starters or VSDs.

Gases

1. Compare the different methods of generating compressed air.
2. Compare the different classes of compressed air and describe how they are relevant for different distilling applications.
3. Explain the typical components in a compressed air system.
4. Describe the ways in which oxygen can be supplied, stored, generated, and used.

Carbon Dioxide Recovery Technology

1. Describe and calculate the CO2 production potential of the contents of a fermenter (washback) in terms of wort volume and original extract (OE).
2. Calculate the overall collection efficiency of a CO2 recovery plant, over time, against a production schedule.
3. Describe the function of various approaches to switching tanks over from CO2 vent to CO2 collection and suggest their appropriateness for differing sized distillery operations.
4. List the key processes of a recovery plant and their principle of operation.

UNIT 6: PROCESS CONTROL AND INSTRUMENTATION

Candidates are required to have an in-depth understanding of the following:

Principles of Process Control

1. Explain how the different components within a process control system relate to the different levels of control.
2. Compare the different options available for control (PLC/PC/standalone controllers).
3. Explain the workings of control elements such as pneumatic control valves and VSDs.
4. Top of Form.
5. Bottom of Form.

Process Instrumentation

1. Understand how to apply the factors that influence instrument selection.
2. Describe the principles by which common distillery instruments work and use these principles to evaluate different instruments.
3. Recommend instruments for specific distillery applications.

Process Control Mechanisms

1. Describe the basic components of a control loop and understand how to apply these to real distilling situations.
2. Compare self-acting, discrete, and continuous control; understand how to apply each of these within different distilling scenarios.
3. Explain the principles of PID control and describe how the different components affect the controller response.
4. Recommend process controller configurations for typical distillery applications.

UNIT 7: MATERIALS OF CONSTRUCTION

Candidates are required to have an in-depth understanding of the following:

Classification and Properties

1. Apply material classification to different materials.
2. Understand the different properties of materials.
3. Understand the most common forms of corrosion and degradation.
4. Recommend the best metal joining practices for common materials used in distilling, such as stainless steel and copper.

Materials Application In Distilling

1. Compare the advantages and disadvantages of materials commonly used in a distillery.
2. Recommend the best grade of stainless steel for different distilling applications.
3. Explain why certain materials are used in different applications.

Hygienic Design

1. Apply the principles of hygienic design to a distillery.
2. Describe what is necessary in order for common processing equipment design to comply with hygienic requirements.
3. Recommend how to use organisations to ensure your processing equipment and facility adhere to hygienic design principles.