# Model Curriculum

**QP Name: Microbiologist (Food)**

**QP Code: FIC/Q7603**

**Version: 4.0**

**NSQF Level: 5.0**

**Model Curriculum Version: 4.0**

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# Training Parameters

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|---|---|
| **Sector** | Food Processing |
| **Sub-Sector** | Fruits and Vegetables, Food Grain Milling (Including oil seeds), Dairy Products, Meat and Poultry, Fish and Seafood, Bread and Bakery, Alcoholic Beverages, Aerated Water/Soft Drinks |
| **Occupation** | Quality Analysis/ Assurance |
| **Country** | India |
| **NSQF Level** | 5 |
| **Aligned to NCO/ISCO/ISIC Code** | NCO-2015/3116.0200 |
| **Minimum Educational Qualification and Experience** | UG Diploma (in Food Science or Microbiology or Applied Science) with 3 Years of experience in Food Quality Testing or Quality Control<br>OR<br>Previous relevant Qualification of NSQF Level (4.5) with 3 Years of experience in Food Quality Testing or Quality Control<br>OR<br>Previous relevant Qualification of NSQF Level (4.0) with 4.5 years of experience in Food Quality Testing or Quality Control |
| **Pre-Requisite License or Training** | NA |
| **Minimum Job Entry Age** | 21 Years |
| **Last Reviewed On** | 18-02-2025 |
| **Next Review Date** | 17-02-2028 |
| **NSQC Approval Date** | 18-02-2025 |
| **QP Version** | 4.0 |
| **Model Curriculum Creation Date** | 18-02-2025 |
| **Model Curriculum Valid Up to Date** | 17-02-2028 |
| **Model Curriculum Version** | 4.0 |
| **Minimum Duration of the Course** | 510 Hours |
| **Maximum Duration of the Course** | 510 Hours |

# Program Overview

This section summarises the end objectives of the program along with its duration.

## Training Outcomes

At the end of the program, the learner should have acquired the listed knowledge and skills to:

- Explain preparation and maintenance of laboratory work areas and equipment for microbiological analysis.
- Demonstrate carrying out microbiological analysis of food products using appropriate techniques.
- Explain best practices for workplace to maintain a safe and hygienic food testing laboratory environment.
- Discuss the Employability and Entrepreneurship Skills.

## Compulsory Modules

The table lists the modules and their duration corresponding to the Compulsory NOS of the QP.

| NOS and Module Details | Theory Duration (Hours) | Practical Duration (Hours) | On-the-Job Training Duration (Mandatory) (Hours) | On-the-Job Training Duration (Recommended) (Hours) | Total Duration (Hours) |
|---|---|---|---|---|---|
| **FIC/N7609: Prepare and maintain the work area and lab equipment**<br>**NOS Version No.: 2.0**<br>**NSQF Level: 5.0** | **60:00** | **90:00** | **60:00** | **00:00** | **210:00** |
| Module 1: Introduction to the job role of a Microbiologist (Food) | 05:00 | 00:00 | 00:00 | 00:00 | 05:00 |
| Module 2: Microbiological Testing Foundations | 20:00 | 40:00 | 30:00 | 00:00 | 90:00 |
| Module 3: Sample Handling and Documentation | 15:00 | 20:00 | 10:00 | 00:00 | 45:00 |
| Module 4: Equipment Maintenance and Calibration | 10:00 | 20:00 | 10:00 | 00:00 | 40:00 |
| Module 5: Lab Hygiene and Compliance | 10:00 | 10:00 | 10:00 | 00:00 | 30:00 |
| **FIC/N7610: Carry out microbiological analysis of food products**<br>**NOS Version No.: 2.0**<br>**NSQF Level: 5.0** | **60:00** | **90:00** | **60:00** | **00:00** | **210:00** |
| Module 6: Sample Collection and Preparation | 15:00 | 20:00 | 20:00 | 00:00 | 55:00 |

| | | | | | |
|---|---|---|---|---|---|
| Module 7: Microorganism Cultivation and Isolation | 20:00 | 25:00 | 20:00 | 00:00 | 65:00 |
| Module 8: Microbiological Testing and Interpretation | 20:00 | 25:00 | 20:00 | 00:00 | 65:00 |
| Module 9: Laboratory Safety and Quality Standards | 05:00 | 20:00 | 00:00 | 00:00 | 25:00 |
| **FIC/N9907: Apply food safety and Maintain hygiene in the laboratory**<br>**NOS Version No.: 2.0**<br>**NSQF Level: 3.5** | **10:00** | **20:00** | **00:00** | **00:00** | **30:00** |
| Module 10: Apply food safety and Maintain hygiene in the laboratory | 10:00 | 20:00 | 00:00 | 00:00 | 30:00 |
| **DGT/VSQ/N0102: Employability Skills (60 Hours)**<br>**NOS Version No.: 1.0**<br>**NSQF Level: 4.0** | **60:00** | **00:00** | **00:00** | **00:00** | **60:00** |
| Module 11: Employability Skills (60 Hours) | 60:00 | 00:00 | 00:00 | 00:00 | 60:00 |
| **Total Duration** | **190:00** | **200:00** | **120:00** | **00:00** | **510:00** |

# Module Details

## Module 1: Introduction to the job role of a Microbiologist (Food)

***Mapped to FIC/N7609, v3.0***

**Terminal Outcomes:**

- Explain the importance of Food Processing Industry.
- Discuss the roles and responsibilities of a Microbiologist (Food).

| **Duration (in hours): 05:00** | **Duration (in hours): 00:00** |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Define food processing.<br>• Describe the various sub-sectors of food processing industry.<br>• Discuss the scope of employment in the food processing industry.<br>• Describe the roles & responsibilities of a Microbiologist (Food).<br>• Discuss the future trends and career growth opportunities available to a Microbiologist (Food). | |
| **Classroom Aids** | |
| Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films | |
| **Tools, Equipment and Other Requirements** | |
| Nil | |

## Module 2: Microbiological Testing Foundations

***Mapped to FIC/N7609, v2.0***

**Terminal Outcomes:**

- Explain the basic concepts of microbiology and the role of microbiological testing in ensuring food safety.
- Discuss the different microbiological hazards (physical, chemical, biological) relevant to food products.

| **Duration (in hours): 20:00** | **Duration (in hours): 40:00** |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Describe the purpose and principles of microbiological testing of food.<br>• Discuss different culture media (e.g., agar, broth) and their selection based on the contaminants being tested, including preparation and storage protocols.<br>• Discuss metrology techniques relevant to lab testing procedures.<br>• Outline the effect of lab equipment settings on microbiological testing of food samples.<br>• Explain the safety rules and environmental requirements applicable to working in lab environments.<br>• Discuss different culture media and their selection based on contaminants.<br>• Describe the proper use of PPE and lab safety protocols, including functionality checks for safety equipment. | • Demonstrate how to ensure the availability of raw materials, agar, broth, chemicals, distilled water, glassware, and essential testing tools, such as flasks, pipettes, autoclaves, and incubators.<br>• Show how to select the appropriate media for testing based on the contaminants being analyzed.<br>• Demonstrate the systematic organization of the workspace, arranging tools, materials, and samples to avoid clutter during microbiological testing.<br>• Show how to ensure that all safety gear, including gloves, goggles, and lab coats, is in usable condition before beginning any procedures.<br>• Demonstrate how to check and verify that safety equipment, such as eyewash stations and fire extinguishers, is functional and easily accessible.<br>• Demonstrate the preparation of media culture, agar plates, sterile solutions, and nutrient broth for food sample analysis, including proper storage protocols.<br>• Show how to correctly place media culture or broth into the autoclave following standard procedures.<br>• Demonstrate how to set autoclave parameters, including temperature, duration, pressure, and water level, based on the specific requirements.<br>• Show the monitoring of sterilization process and safely turning off the |

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| | autoclave after the required pressure and temperature are achieved.<br>• Show how to release autoclave pressure safely and remove sterilized items following standard procedures.<br>• Demonstrate the proper cooling and storage of sterilized items in a sterile area, ensuring adherence to standard protocols.<br>• Show how to verify that reagents meet the required quality standards before use in testing.<br>• Demonstrate the preparation of food samples for microbiological testing according to organizational procedures.<br>• Show how to store food samples appropriately, following the standard storage requirements. |
| **Classroom Aids** | |
| Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films | |
| **Tools, Equipment and Other Requirements** | |
| Agar Plates, Nutrient Broth, Culture Media (e.g., Agar, Broth), Autoclave, Incubators, Pipettes, Flasks, Test Tubes, Petri Dishes, Bunsen Burner, Glassware (e.g., Beakers, Graduated Cylinders), Sterile Solutions, Distilled Water, Safety Gloves, Lab Coats, Safety Goggles, Safety Masks, Eyewash Station, Fire Extinguisher, Reagent Bottles, Thermometer, Pressure Gauge, Sterile Storage Containers, Sterilizing Tools, pH Meters, Chemical Reagents, Micropipettes, Media Preparation Tools, Tweezers, Forceps, Laboratory Balance, Heat-Resistant Gloves. | |

## Module 3: Sample Handling and Documentation

***Mapped to FIC/N7609, v2.0***

**Terminal Outcomes:**

- Demonstrate the correct procedures for collecting, labelling, and storing food samples to prevent contamination.
- Show how to accurately complete sample handling documentation for traceability and compliance.

| **Duration (in hours): 15:00** | **Duration (in hours): 20:00** |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Explain the methods for handling and storing food samples to prevent contamination.<br>• Discuss the quality requirements for reagents, chemicals, and testing materials used in microbiological analysis.<br>• Describe proper logging and documentation procedures, including sample descriptions and traceability.<br>• Explain protocols for identifying and reporting sample discrepancies to relevant authorities. | • Demonstrate the accurate logging of sample information, including descriptions and comparisons with specifications, following Standard Operating Procedures (SOPs).<br>• Show how to record and report any sample discrepancies to the relevant authorities.<br>• Demonstrate how to maintain traceable sample records for reporting test results. |
| **Classroom Aids** | |
| Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films | |
| **Tools, Equipment and Other Requirements** | |
| Sample Logbook, Food Sample Storage Containers, Sample Labels, Sterile Sample Bags, Standard Operating Procedures (SOP) Manuals, Sterile | |

## Module 4: Equipment Maintenance and Calibration

***Mapped to FIC/N7609, v2.0***

**Terminal Outcomes:**

- Explain the importance of regular maintenance and calibration in ensuring test reliability and compliance with lab safety standards.
- Demonstrate the correct method of cleaning and maintaining lab equipment.
- Show how to calibrate common microbiological testing equipment and troubleshoot any minor issues.

| **Duration (in hours): 10:00** | **Duration (in hours): 20:00** |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Discuss the operation and maintenance of key lab equipment, including calibration techniques.<br>• Describe how to set appropriate autoclave parameters, i.e., temperature, pressure, and duration.<br>• Discuss how to identify and rectify wear and tear or malfunctioning components in lab equipment. | • Show how to check laboratory equipment, such as incubators, microscopes, and autoclaves, to ensure proper functionality.<br>• Demonstrate regular cleaning and maintenance of lab equipment to prevent cross-contamination.<br>• Show how to set up and calibrate lab equipment according to the specific test method requirements.<br>• Demonstrate the routine inspection of lab equipment to identify signs of wear, tear, or malfunctioning components.<br>• Show how to replace faulty or unsafe components in equipment or coordinate repairs with manufacturers when needed.<br>• Demonstrate how to maintain a logbook for tracking equipment maintenance schedules and repairs. |
| **Classroom Aids** | |
| Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films | |
| **Tools, Equipment and Other Requirements** | |
| Autoclave, Incubator, Microscope, Calibration Weights, Calibration Solutions, Maintenance Logbook, Thermometer, Pressure Gauge, Sterile Cleaning Supplies, Replacement Parts Kit, Multimeter, Screwdrivers | |

## Module 5: Lab Hygiene and Compliance

***Mapped to FIC/N7609, v2.0***

**Terminal Outcomes:**

- Explain the significance of maintaining cleanliness and sterility in a microbiology lab.
- Show how to follow good laboratory practices and hygiene protocols.
- Demonstrate the correct use of personal protective equipment (PPE) and proper disposal techniques for laboratory waste.

| **Duration (in hours): 10:00** | **Duration (in hours): 10:00** |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Discuss the appropriate cleaning agents and sanitizers, as well as recommended practices for maintaining a hygienic and sterile lab environment to minimize cross-contamination.<br>• Describe the safety procedures for handling sterilized items.<br>• List the safe disposal practices for laboratory and hazardous waste.<br>• Discuss the procedures for identifying, documenting, and reporting food safety and quality non-compliance issues. | • Demonstrate the correct use of Personal Protective Equipment (PPE) to ensure personal safety in the lab.<br>• Demonstrate monitoring of cleaning and sanitizing of the lab using appropriate cleaning agents and sanitizers.<br>• Demonstrate the measures to minimize waste generation and environmental impacts during lab procedures.<br>• Show how to safely collect and dispose of laboratory and hazardous waste.<br>• Demonstrate proper storage procedures for lab equipment and reagents in designated areas.<br>• Show how to identify, document, and report food safety and quality non-compliance issues according to SOPs. |
| **Classroom Aids** | |
| Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films | |
| **Tools, Equipment and Other Requirements** | |
| PPE (Gloves, Goggles, Lab Coats), Cleaning Agents, Sanitizers, Biohazard Waste Bins, Autoclave Bags, Hazardous Waste Disposal Containers, Spill Kits, Safety Data Sheets (SDS), Documentation Forms, Waste Collection Tools, Labeling Supplies. | |

## Module 6: Sample Collection and Preparation

***Mapped to FIC/N7610, v2.0***

**Terminal Outcomes:**

- Demonstrate the process of collecting representative food samples for microbiological analysis.
- Explain the techniques for preventing contamination during sample collection and preparation.

| **Duration (in hours): 15:00** | **Duration (in hours): 20:00** |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Define the physiological characteristics of microbial cells, including their structure and function.<br>• Describe the basic microbiological terminology, including microbial morphology, physiology, and taxonomy.<br>• Explain the purpose and use of peptone water as a diluent and enrichment medium for the recovery of microorganisms.<br>• Discuss the importance of collecting swabs for monitoring hygiene and detecting microbial contamination in different areas, such as surfaces, air, and equipment.<br>• Explain the principles and methods of disinfection and sterilization, such as autoclaving, chemical sterilization, and UV sterilization, to prevent contamination.<br>• Describe the use of microscopy for observing the morphological characteristics of microbial cells in wet mounts and stained preparations.<br>• Identify the appropriate use of Personal Protective Equipment (PPE), such as gloves, lab coats, and masks, and biological safety cabinets to ensure laboratory safety. | • Demonstrate the use of sterile swabs and equipment to collect samples from designated areas, such as hands, air, and equipment, according to standard procedures.<br>• Show how to transfer swabs into test tubes containing sterile buffered peptone water or appropriate diluent without contamination.<br>• Demonstrate ensuring that sample collection is conducted under appropriate lighting and environmental conditions.<br>• Show how to shake the test tube gently and allow it to stand as per specified protocols to release microorganisms into the solution.<br>• Demonstrate the removal of the swab and analysis of the sample as per laboratory specifications and standard operating procedures (SOPs).<br>• Show how to apply correct disinfection procedures to work areas before and after handling samples to prevent cross-contamination.<br>• Demonstrate the preparation and staining of thin smears and liquid films of samples for microscopic examination.<br>• Show how to set up and calibrate microscopes, ensuring proper magnification and resolution for accurate observation of microorganisms.<br>• Demonstrate the examination of dry, wet, and stained specimens to identify microbial structures and characteristics. |

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| | • Show how to maintain, clean, and store microscopes and related equipment as per standard protocols. |
| **Classroom Aids** | |
| Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films | |
| **Tools, Equipment and Other Requirements** | |
| Microscopes, Sterile Swabs, Test Tubes, Peptone Water, Biological Safety Cabinets, Sterile Diluent, Staining Kits, Disinfectants, Autoclave, UV Sterilizer, Chemical Sterilizers, PPE (Gloves, Lab Coats, Masks), Microscope Slides, Coverslips, Sample Collection Tools, Storage Racks. | |

## Module 7: Microorganism Cultivation and Isolation

***Mapped to FIC/N7610, v2.0***

**Terminal Outcomes:**

- Demonstrate how to cultivate microorganisms using different media and incubation techniques.
- Show how to isolate specific microorganisms from food samples for identification and further testing.

| **Duration (in hours): 20:00** | **Duration (in hours): 25:00** |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Explain microbial diversity, including different types of bacteria, fungi, and viruses relevant to food production and spoilage.<br>• Explain microbial ecology and factors influencing the growth of pathogens and non-pathogens in various food matrices.<br>• Describe microbial growth patterns and survival under various conditions.<br>• Explain chemical and physical methods for controlling microbial growth.<br>• Discuss the application of microscopy to observe morphological characteristics of microbial cells.<br>• Explain techniques for cultivating and isolating microorganisms using different media and environmental conditions.<br>• Identify common types of bacteria using biochemical and molecular methods.<br>• Describe the types of selective and differential media used for isolating and identifying specific groups of micro-organisms.<br>• Discuss methods for maintaining pure cultures and preventing cross-contamination during isolation and identification processes. | • Demonstrate the preparation and use of culture media, agar plates, and broth as per laboratory requirements.<br>• Show how to apply aseptic techniques to streak samples on agar plates to isolate single colonies of microorganisms (TPC, yeast and mould, and salmonella tests)<br>• Demonstrate the selection of appropriate incubation conditions, such as temperature and gaseous environment, to support the growth of specific microorganisms.<br>• Show how to perform serial dilutions of samples accurately to determine microbial load.<br>• Demonstrate the monitoring and recording of bacterial growth, estimating colony-forming units (CFU) as required by testing protocols.<br>• Show how to select appropriate media and incubation conditions for culturing both pathogenic and non-pathogenic microorganisms.<br>• Demonstrate the methods for maintaining pure cultures and preventing cross-contamination during isolation and identification processes.<br>• Demonstrate the implementation of selective and differential media for distinguishing between microbial groups.<br>• Show how to count colonies and identify morphological characteristics of cultured pathogens and non-pathogens. |

| Classroom Aids |
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| Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films |
| **Tools, Equipment and Other Requirements** |
| Agar Plates, Broth Media, Culture Media, Incubators, Sterile Petri Dishes, Inoculation Loops, Sterile Pipettes, Test Tubes, Selective and Differential Media, Biochemical Test Kits, PPE (Gloves, Lab Coats, Masks), Microscope, Staining Kits, Colony Counters, Serial Dilution Tools, Refrigerated Storage Units, CFU Estimation Charts, Sterile Forceps, Sterile Workbenches. |

## Module 8: Microbiological Testing and Interpretation

*Mapped to FIC/N7610, v2.0*

**Terminal Outcomes:**

- Demonstrate the use of common microbiological testing methods.
- Explain how to interpret microbiological test results.

| Duration (in hours): 20:00 | Duration (in hours): 25:00 |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Explain the principles and procedures of ELISA, including the different types (direct, indirect, sandwich) and its applications in food safety testing.<br>• Discuss the fundamentals of PCR and qPCR, including sample preparation, amplification cycles, and interpretation of data.<br>• Identify the key food regulatory frameworks, such as FSSAI and Codex Alimentarius, relevant to the organization's products.<br>• Explain the criteria for selecting appropriate controls and standards for ELISA and PCR assays.<br>• Identify common pathogens and non-pathogens, such as Listeria and beneficial probiotics, relevant to food safety and quality.<br>• Describe the regulatory standards for microbial limits in food products, following FSSAI and international guidelines.<br>• Explain the principles of the TPC method, including sample preparation and serial dilution for determining total microbial load.<br>• Describe plating techniques used in the TPC method for accurate microbial quantification.<br>• Explain the significance of yeast and mould tests and the use of selective media for fungal contamination.<br>• Describe the incubation conditions necessary for yeast and mould detection.<br>• Discuss the importance of Salmonella detection in food safety and the role of enrichment media. | • Demonstrate the conduction of biochemical and serological tests on pure cultures to identify specific microorganisms.<br>• Demonstrate the process of conducting TPC (Total Plate Count) tests to quantify total microbial load.<br>• Show how to conduct yeast and mould tests, using selective media and setting appropriate incubation conditions for fungal growth detection.<br>• Demonstrate the interpretation of yeast and mould test results in accordance with standard limits for acceptable fungal contamination.<br>• Demonstrate the preparation of enrichment media for Salmonella testing, following standard laboratory protocols.<br>• Show how to conduct Salmonella detection using biochemical or serological methods.<br>• Show how to prepare and use stained slides to observe morphological features of bacteria and other microbes.<br>• Demonstrate the comparison of test results with standard parameters and critical limits, identifying any deviations or anomalies.<br>• Show how to document and communicate test results and deviations to the relevant authorities as per organizational procedures.<br>• Demonstrate the performance of Enzyme-Linked Immunosorbent Assay (ELISA) to detect specific antigens or antibodies in |

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|---|---|
| • Explain selective plating and biochemical or serological methods for identifying Salmonella.<br>• Explain interpretation of TPC, yeast and mould, and Salmonella test results by comparing microbial counts to regulatory standards.<br>• Identify factors influencing microbial growth, such as moisture, temperature, pH, and oxygen levels and their impact on TPC, yeast and mould, and Salmonella tests. | food samples, ensuring accuracy and compliance with test protocols.<br>• Show how to conduct Polymerase Chain Reaction (PCR) for the detection and identification of DNA from pathogenic and non-pathogenic organisms in food samples.<br>• Demonstrate the utilization of Real-Time PCR (qPCR) for quantitative analysis of microbial load in food products.<br>• Show how to validate test results by comparing them with standard controls and reporting any deviations.<br>• Demonstrate the differentiation between pathogens (e.g., Salmonella, E. coli) and non-pathogens (e.g., Lactobacillus) using biochemical and molecular techniques.<br>• Show how to document and report test findings, including interpretations and implications for food safety. |
| **Classroom Aids** | |
| Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films | |
| **Tools, Equipment and Other Requirements** | |
| ELISA Kits, PCR Kits, qPCR Machines, Thermal Cyclers, Microcentrifuges, Micropipettes, Sterile Tubes, PCR Plates, ELISA Plates, Reagents for ELISA and PCR, Standard Controls and Calibration Solutions, Staining Kits, Microscope, Incubators, DNA Extraction Kits, Gel Electrophoresis Equipment, UV Transilluminators, PPE (Gloves, Lab Coats, Masks), Sample Preparation Tools, Real-Time PCR Software, Regulatory Documentation Templates, Colony Counters, Biochemical Test Kits, Pathogen Identification Charts, Laboratory Notebooks. | |

## Module 9: Laboratory Safety and Quality Standards

***Mapped to FIC/N7610, v2.0***

**Terminal Outcomes:**

- Explain the critical safety protocols necessary in food testing laboratories.

| **Duration (in hours): 05:00** | **Duration (in hours): 20:00** |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Explain the appropriate use of Personal Protective Equipment (PPE) to ensure laboratory safety.<br>• Discuss the principles of disinfection and sterilization methods applied to prevent contamination.<br>• Explain the advantages and limitations of different sterilization methods for controlling specific microorganisms.<br>• Describe the principles and practices of quality assurance in food testing laboratories to ensure reliable results.<br>• Explain the health, safety, and environmental requirements in a microbiology lab to minimize risks and ensure safe handling of bio-hazardous materials. | • Demonstrate the following of laboratory safety guidelines, using personal protective equipment (PPE) and biosafety protocols.<br>• Show how to implement quality control measures to ensure the accuracy and precision of microbiological test results.<br>• Demonstrate the recording and reporting of all test data in compliance with laboratory quality management systems.<br>• Show how to dispose of samples, media, and biohazardous waste according to established safety procedures. |
| **Classroom Aids** | |
| Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films | |
| **Tools, Equipment and Other Requirements** | |
| PPE (Gloves, Lab Coats, Masks, Goggles), Autoclaves, Disinfectants, Sterilizers, Biohazard Waste Disposal Containers, Sterile Test Tubes, Incubators, Micropipettes, Biosafety Cabinets, Quality Control Charts, Laboratory Logbooks, Sample Disposal Bags, Hazardous Waste Bins, Safety Signs, Sterile Media, Autoclave Bags, Cleaning Agents, Fire Extinguishers, Emergency Eyewash Stations, Laboratory Notebooks, Sterilization Indicator Strips | |

## Module 10: Apply food safety and hygiene in the food laboratory

***Mapped to FIC/N9907, v2.0***

**Terminal Outcomes:**

- Explain how to implement practices to maintain food safety and hygiene in laboratory.

| **Duration (in hours): 10:00** | **Duration (in hours): 20:00** |
|---|---|
| **Theory – Key Learning Outcomes** | **Practical – Key Learning Outcomes** |
| • Explain the concept of HACCP and how it helps in identifying and controlling food safety hazards.<br>• Describe the causes of foodborne illnesses and their impact on food safety.<br>• Discuss the latest updates and key elements of food safety regulations, including standards for products, packaging, and labelling.<br>• Explain the purpose and scope of NABL accreditation and its influence on laboratory operations.<br>• Elucidate the NABL guidelines and your role in complying with them in a food testing lab.<br>• Describe the importance and use of Material Safety Data Sheets (MSDS) in categorizing and storing chemicals in food testing labs.<br>• Discuss the principles of Good Laboratory Practices (GLP) and how they contribute to high-quality and reliable lab results.<br>• Explain the relevance of FSSAI guidelines and standards to food testing laboratories.<br>• Describe standard food safety protocols and how they are applied in laboratory settings.<br>• Elucidate food allergens and the techniques used for their identification and management in the lab.<br>• Determine the procedure for conducting food safety audits and explain the importance of compliance with relevant standards. | • Demonstrate how to identify and control food safety hazards, including cross-contamination risks and allergen management, within the lab.<br>• Show how to implement and maintain hygiene, sanitation, and food safety protocols in accordance with Good Laboratory Practices (GLP).<br>• Demonstrate how to access, interpret, and apply updated food safety regulations and standards related to products, packaging, and labelling.<br>• Show how to collect, label, and store biological samples properly to prevent contamination and degradation.<br>• Demonstrate proper waste segregation and disposal practices for biological, chemical, sharps, and general waste using labeled bins.<br>• Show how to ensure MSDS are accessible to personnel and apply the information to categorize and store chemicals safely by compatibility and hazard class.<br>• Demonstrate proper storage practices in the lab, including maintaining temperature and humidity control as per organizational standards.<br>• Show how to troubleshoot minor equipment issues and report major malfunctions to the appropriate authority promptly.<br>• Demonstrate participation in lab audits and maintain accurate records and documentation as required. |

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| • Describe good hygiene and sanitation practices critical to maintaining food safety in laboratory environments. | • Show how to ensure timely referral to a medical practitioner for foodborne illness symptoms among lab personnel. |
| **Classroom Aids** | |
| Training Kit - Facilitator's Guide, Participant's Handbook, Presentations and Software, Whiteboard, Marker, Projector, Laptop, Video Films | |
| **Tools, Equipment and Other Requirements** | |
| PPE (Gloves, Masks, Hairnets), Sanitizers, Disinfectants, Fire Extinguishers, First Aid Kits, Eyewash Stations, Safety Checklists, Audit Forms, Labelling Materials, Storage Containers, Cleaning Agents, Temperature Monitoring Devices, Safety Signs, Packaging Materials | |

## Module 11: Employability Skills (60 Hours)

*Mapped to DGT/VSQ/N0102, v1.0*

**Duration (in hours): 60:00**

**Key Learning Outcomes**

After completing this programme, participants will be able to:

**Introduction to Employability Skills Duration: 1.5 Hours**

1. Discuss the Employability Skills required for jobs in various industries
2. List different learning and employability related GOI and private portals and their usage

**Constitutional values - Citizenship Duration: 1.5 Hours**

3. Explain the constitutional values, including civic rights and duties, citizenship, responsibility towards society and personal values and ethics such as honesty, integrity, caring and respecting others that are required to become a responsible citizen
4. Show how to practice different environmentally sustainable practices.

**Becoming a Professional in the 21st Century Duration: 2.5 Hours**

5. Discuss the importance of relevant 21st-century skills.
6. Exhibit 21st-century skills like Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn etc. in personal or professional life.
7. Describe the benefits of continuous learning.

**Basic English Skills Duration: 10 Hours**

8. Show how to use basic English sentences for everyday conversation in different contexts, in person and over the telephone
9. Read and interpret text written in basic English
10. Write a short note/paragraph / letter/e -mail using basic English

**Career Development & Goal Setting Duration: 2 Hours**

11. Create a career development plan with well-defined short- and long-term goals

**Communication Skills Duration: 5 Hours**

12. Demonstrate how to communicate effectively using verbal and nonverbal communication etiquette.
13. Explain the importance of active listening for effective communication
14. Discuss the significance of working collaboratively with others in a team

**Diversity & Inclusion Duration: 2.5 Hours**

15. Demonstrate how to behave, communicate, and conduct oneself appropriately with all genders and PwD
16. Discuss the significance of escalating sexual harassment issues as per POSH act.

**Financial and Legal Literacy Duration: 5 Hours**

17. Outline the importance of selecting the right financial institution, product, and service

18. Demonstrate how to carry out offline and online financial transactions, safely and securely
19. List the common components of salary and compute income, expenditure, taxes, investments etc.
20. Discuss the legal rights, laws, and aids

**Essential Digital Skills Duration: 10 Hours**

21. Describe the role of digital technology in today's life
22. Demonstrate how to operate digital devices and use the associated applications and features, safely and securely
23. Discuss the significance of displaying responsible online behavior while browsing, using various social media platforms, e-mails, etc., safely and securely
24. Create sample word documents, excel sheets and presentations using basic features
25. utilize virtual collaboration tools to work effectively

**Entrepreneurship Duration: 7 Hours**

26. Explain the types of entrepreneurship and enterprises
27. Discuss how to identify opportunities for potential business, sources of funding and associated financial and legal risks with its mitigation plan
28. Describe the 4Ps of Marketing-Product, Price, Place and Promotion and apply them as per requirement
29. Create a sample business plan, for the selected business opportunity

**Customer Service Duration: 5 Hours**

30. Describe the significance of analyzing different types and needs of customers
31. Explain the significance of identifying customer needs and responding to them in a professional manner.
32. Discuss the significance of maintaining hygiene and dressing appropriately

**Getting Ready for apprenticeship & Jobs Duration: 8 Hours**

33. Create a professional Curriculum Vitae (CV)
34. Use various offline and online job search sources such as employment exchanges, recruitment agencies, and job portals respectively
35. Discuss the significance of maintaining hygiene and confidence during an interview
36. Perform a mock interview
37. List the steps for searching and registering for apprenticeship opportunities

## Module 12: On-the-Job Training

*Mapped to Microbiologist (Food)*

| Mandatory Duration: 120:00 | Recommended Duration: 00:00 |
|---|---|
| **Location: On-Site** | |

**Terminal Outcomes**

- Demonstrate how to collect, label, and store food samples properly to prevent contamination.
- Show how to complete sample handling documentation accurately for traceability and compliance.
- Demonstrate the correct method of cleaning and maintaining microbiology lab equipment.
- Show how to calibrate common microbiological testing equipment and troubleshoot minor issues.
- Demonstrate the proper use of personal protective equipment (PPE) and safe disposal of laboratory waste.
- Show how to follow good laboratory practices and hygiene protocols in a microbiology lab.
- Demonstrate the correct procedure for collecting representative food samples for microbiological analysis.
- Show how to prevent contamination during food sample collection and preparation.
- Demonstrate cultivation of microorganisms using appropriate media and incubation techniques.
- Show how to isolate specific microorganisms from food samples for identification and further testing.
- Demonstrate the use of common microbiological testing methods used in food safety.
- Show how to interpret microbiological test results accurately.
- Demonstrate how to implement hygiene and safety practices to maintain food safety in a laboratory setting.
- Show how to apply critical safety protocols specific to food testing laboratories.

# Annexure

## Trainer Requirements

| Trainer Prerequisites | | | | | | |
|---|---|---|---|---|---|---|
| **Minimum Educational Qualification** | **Specialisation** | **Relevant Industry Experience** | | **Training Experience** | | **Remarks** |
| | | ***Years*** | ***Specialization*** | ***Years*** | ***Specialization*** | |
| B.Sc/B.Tech | Food Technology/Food Microbiology/Food Engineering/ Biotechnology/ Biochemistry | 3 | Food Microbiology | 1 | Microbiologist (Food) | |
| M.Sc./M.Tech | Food Technology/Food Microbiology/Food Engineering/ Biotechnology/ Biochemistry | 2 | Food Microbiology | 1 | Microbiologist (Food) | |

| Trainer Certification | |
|---|---|
| **Domain Certification** | **Platform Certification** |
| Certified for Job Role: "Microbiologist (Food)" mapped to QP: "FIC/Q7603, v4.0". Minimum accepted score is 80%. | Recommended that the Trainer is certified for the Job Role: "Trainer (VET and Skills)", mapped to the Qualification Pack: "MEP/Q2601, v2.0". The minimum accepted score as per MEPSC guidelines is 80%. |

## Assessor Requirements

| Assessor Prerequisites | | | | | | |
|---|---|---|---|---|---|---|
| **Minimum Educational Qualification** | **Specialization** | **Relevant Industry Experience** | | **Training/Assessment Experience** | | **Remarks** |
| | | ***Years*** | ***Specialization*** | ***Years*** | ***Specialization*** | |
| B.Sc/B.Tech | Food Technology/Food Microbiology/Food Engineering/ Biotechnology/ Biochemistry | 5 | Food Microbiology | 1 | Microbiologist (Food) | |
| M.Sc./ M.Tech | Food Technology/Food Microbiology/Food Engineering/ Biotechnology/ Biochemistry | 4 | Food Microbiology | 1 | Microbiologist (Food) | |

| Assessor Certification | |
|---|---|
| **Domain Certification** | **Platform Certification** |
| Certified for Job Role: "Microbiologist (Food)" mapped to QP: "FIC/Q7603, v4.0". Minimum accepted score is 80%. | Certified for the Job Role: "Assessor (VET and Skills)", mapped to the Qualification Pack: "MEP/Q2701, v2.0", with a minimum score of 80%. |

## Assessment Strategy

This section includes the processes involved in identifying, gathering and interpreting information to evaluate the learner on the required competencies of the program.

Assessment will be based on the concept of Independent Assessors empanelled with Assessment Agencies, identified, selected, trained and certified on Assessment techniques. These Assessors would be aligned to assess as per the laid down criteria.

Assessment Agency would conduct assessment only at the training centres of Training Partner or designated testing centers authorized by FICSI.

Ideally, the assessment will be a continuous process comprising of three distinct steps:

A. Mid-term assessment
B. Term/Final Assessment

Each National Occupational Standard (NOS) in the respective QPs will be assigned weightage. There in each Performance Criteria in the NOS will be assigned marks for theory and/or practical based on relative importance and criticality of function.

This will facilitate preparation of question bank / paper sets for each of the QPs. Each of these papers sets/question banks created by the Assessment Agency will be validated by the industry subject matter experts through FICSI, especially with regard to the practical test and the defined tolerances, finish, accuracy etc.

The following tools are proposed to be used for final assessment:

i. Written Test: This will comprise of (i)True/False Statements, (ii)Multiple Choice Questions, (iii)Matching Type Questions. Online system for this will be preferred.
ii. Practical Test: This will comprise a test job to be prepared as per project briefing following appropriate working steps, using necessary tools, equipment and instruments. Through observation it will be possible to ascertain candidate's aptitude, attention to details, quality consciousness etc. The end product will be measured against the pre-decided MCQ filled by the Assessor to gauge the level of his skill achievements.
iii. Structured Interview: This tool will be used to assess the conceptual understanding and the behavioural aspects as regards the job role and the specific task at hand.

**On the Job:**

1. Each module (which covers the job profile of Microbiologist (Food)) will be assessed separately.

2. The candidate must score 50% in each module to successfully complete the OJT.

3. Tools of Assessment that will be used for assessing whether the candidate is having desired skills and etiquette of dealing with customers, understanding needs & requirements, assessing the customer and perform Soft Skills effectively:

- Videos of Trainees during OJT
- Answer Sheets of Question Banks
- Assessing the Logbook entries of Trainees at Employer location
- Employer Performance Feedback.

4. Assessment of each Module will ensure that the candidate is able to:

- Preparing and maintaining the work area and lab equipment.

- Carrying out microbiological analysis of food products.
- Applying Food Safety and Hygiene in the laboratory.

# References

## Glossary

| Term | Description |
|---|---|
| **Declarative Knowledge** | Declarative knowledge refers to facts, concepts and principles that need to be known and/or understood in order to accomplish a task or to solve a problem. |
| **Key Learning Outcome** | Key learning outcome is the statement of what a learner needs to know, understand and be able to do in order to achieve the terminal outcomes. A set of key learning outcomes will make up the training outcomes. Training outcome is specified in terms of knowledge, understanding (theory) and skills (practical application). |
| **OJT (M)** | On-the-job training (Mandatory); trainees are mandated to complete specified hours of training on site |
| **OJT (R)** | On-the-job training (Recommended); trainees are recommended the specified hours of training on site |
| **Procedural Knowledge** | Procedural knowledge addresses how to do something, or how to perform a task. It is the ability to work, or produce a tangible work output by applying cognitive, affective, or psychomotor skills. |
| **Training Outcome** | Training outcome is a statement of what a learner will know, understand and be able to do it upon the completion of the training. |
| **Terminal Outcome** | Terminal outcome is a statement of what a learner will know, understand and be able to do upon the completion of a module. A set of terminal outcomes help to achieve the training outcome. |

## Acronyms and Abbreviations

| Term | Description |
|---|---|
| NCVET | National Council for Vocational Education and Training |
| FICSI | Food Industry Capacity & Skill Initiative |
| QP | Qualification Pack |
| MC | Model Curriculum |
| NSQF | National Skills Qualification Framework |
| NSQC | National Skills Qualification Committee |
| NOS | National Occupational Standards |
| NCO | National Classification of Occupations |
| ES | Employability Skills |
| SOP | Standard Operating Procedures |
| FSSAI | Food Safety and Standards Authority of India |
| PPE | Personal Protective Equipment |
| CFU | Colony-Forming Units |
| PCR | Polymerase Chain Reaction |
| qPCR | Real-Time PCR |
| ELISA | Enzyme-Linked Immunosorbent Assay |
| DNA | Deoxyribonucleic Acid |
| GMP | Manufacturing Practices |
| GHP | Good Hygiene Practices |
| HACCP | Hazard Analysis Critical Control Points |
| VACCP | Vulnerability Assessment Critical Control Points |
| TACCP | Threat Assessment Critical Control Points |
| ISO | International Organization for Standardization |
| CIP | Clean-in-Place |
| COP | Clean-out-of-Place |
| CPR | Cardiopulmonary Resuscitation |
| FEFO | First Expiry, First Out |
| FIFO | First In, First Out |
| RCA | Root Cause Analysis |
| CAPA | Corrective and Preventive Action |