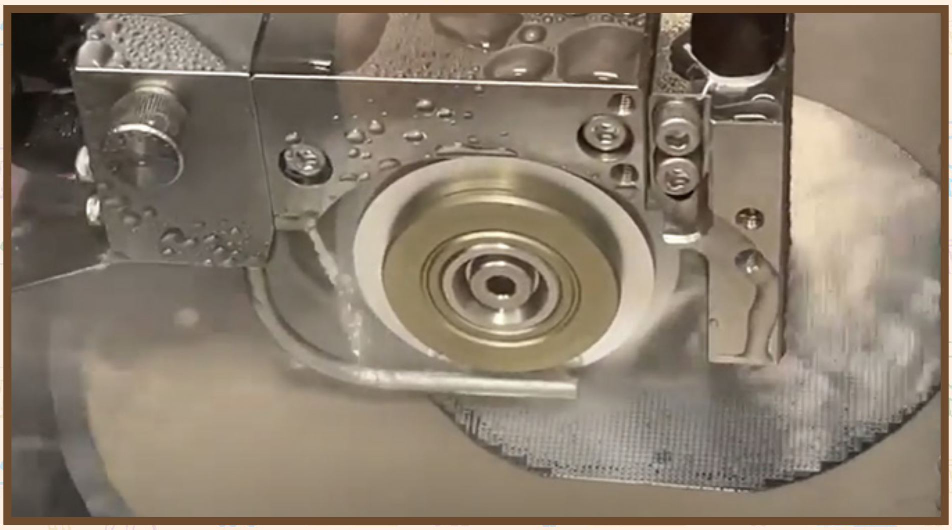
Telecom Sector Skill Council

Facilitator Guide



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Assembly Process Supervisor - Wafer Dicing

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> "Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission."

Shri Narendra Modi
Prime Minister of India

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The preparation of this guide would not have been possible without the telecom industry's support. Industry feedback has been extremely beneficial since inception to conclusion, and it is with the industry's guidance that we have tried to bridge the existing skill gaps in the industry. This facilitator guide is dedicated to the aspiring youth, who desire to achieve special skills that will be a lifelong asset for their future endeavours.

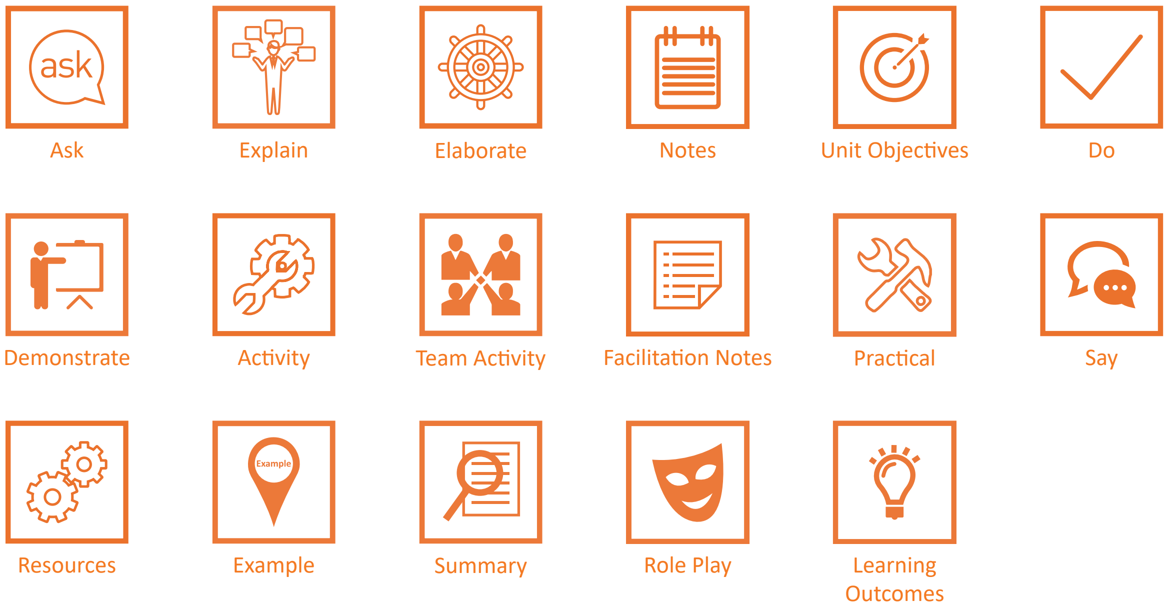
About this book

The facilitator guide (FG) for Assembly Process Supervisor - Wafer Dicing is primarily designed to facilitate skill development and training of people, who want to become Network System Associate in various organizations. The facilitator guide is aligned to the Qualification Pack (QP) and the National Occupational Standards (NOS) as drafted by the Sector Skill Council (TSSC) and ratified by National Skill Development Corporation (NSDC).

It includes the following National Occupational Standards (NOSs)-

1. TEL/ N212: Optimize Dicing Process
2. TEL/ N213: Selecting & Managing Cutting Tools
3. TEL/ N214: Yield Analysis and Improvement Strategies
4. TEL/ N215: Maintain Equipment, Records & Reports
5. DGT/VSQ/N0103: Employability Skills (90 Hours)

Symbols Used



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MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP

N·S·D·C National Skill Development Corporation
Transforming the skill landscape

Telecom Sector Skill Council

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Unit 1.1: Semiconductor Wafer Materials and Their Impact on Dicing
Unit 1.2: Dicing Blade Selection and Safe Handling
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Unit 1.4: Dicing Parameters and Their Influence on Process Efficiency
Unit 1.5: Visual Inspection, Data Analysis, and Process Optimization
Unit 1.6: Preventive Maintenance and Continuous Monitoring

TEL/N7212

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Explain the impact of different semiconductor wafer materials (e.g., silicon, silicon carbide) and their properties (hardness, brittleness) on the dicing process.
2. Interpret wafer design layouts to identify chip dimensions, spacing requirements, and potential challenges for dicing.
3. Explain the principles of selecting dicing blades based on wafer material and desired chip edge quality (smoothness, minimal chipping)
4. Compare and contrast different dicing blade types (e.g., diamond, abrasive) considering their characteristics and suitability for various applications.
5. Explain the factors influencing dicing blade selection, such as cost-effectiveness, compatibility with equipment, and desired cutting performance.
6. Describe safe handling procedures for dicing blades to minimize injury risks.
7. Explain the proper use of dicing equipment controls for stage movement, blade tension, and vibration control.
8. Summarize the key elements of standard operating procedures (SOPs) for dicing equipment setup and calibration.
9. Describe the functionality and purpose of critical dicing equipment components (stage, blade holder, vibration dampener).
10. Explain the importance of accurate record keeping during dicing equipment setup and calibration procedures.
11. Define key dicing parameters (speed, force, blade selection) and explain their influence on throughput, chip quality, and blade wear.
12. Demonstrate the techniques for visual inspection of diced wafers to identify chip damage (cracking, chipping) and edge quality issues.
13. Interpret process data (throughput, cycle time) to assess dicing efficiency and identify potential areas for improvement.
14. Utilize data analysis techniques to identify correlations between process parameters, chip quality, and throughput.
15. Apply iterative optimization principles to balance high throughput with minimal chip damage during the dicing process.
16. Adjust dicing parameters (speed, force, blade selection) based on analysis of process data and wafer inspection results.
17. Continuously monitor dicing process parameters and equipment performance to ensure consistent quality and identify potential issues.
18. Select appropriate data points to record during the dicing process, including parameters used, yield results, cycle time, and blade wear indicators.
19. Utilize designated formats (logs, electronic records) to ensure accurate and consistent recording of dicing process data (KU 21 + Implicit in PC 16).
20. Correlate blade wear data with potential equipment maintenance needs to plan for preventive maintenance activities.

Unit 1.1: Skill India Mission and its Impact on Tourism and Hospitality

Unit Objectives

At the end of this unit, the participants will be able to:

1. Explain the impact of different semiconductor wafer materials (e.g., silicon, silicon carbide) and their properties (hardness, brittleness) on the dicing process.
2. Discuss how wafer material properties influence chip quality and the dicing process.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the impact of different semiconductor wafer materials, such as silicon and silicon carbide, on the dicing process. We will explore how the properties of these materials, including hardness and brittleness, affect both the quality of the chips produced and the efficiency of the dicing process. By understanding these factors, we can optimize manufacturing outcomes.

Ask

Ask the participants the following questions:

- What are the key material properties of silicon and silicon carbide that influence the dicing process?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Impact of Different Semiconductor Wafer Materials on the Dicing Process

The choice of wafer material significantly affects the dicing process. Silicon, widely used due to its moderate hardness and ductility, is easier to dice compared to harder materials like silicon carbide. Silicon carbide, while offering superior thermal and mechanical properties, presents challenges such as increased tool wear and slower dicing speeds due to its high hardness.

Brittle materials like silicon carbide are prone to crack propagation during dicing, which requires advanced techniques like laser dicing or ultrasonic assistance to minimize defects and achieve precision.

Influence of Wafer Material Properties on Chip Quality and Dicing Process

The physical properties of wafer materials, such as hardness, brittleness, and thermal conductivity, play a critical role in determining the quality of chips and the efficiency of the dicing process. Harder materials, like silicon carbide, pose challenges during cutting due to increased tool wear and difficulty in achieving clean cuts, potentially affecting chip precision. Brittle materials are more prone to chipping and crack propagation, which can compromise the structural integrity and reliability of the chips. Additionally, thermal conductivity impacts how heat is dissipated during dicing; materials with higher thermal conductivity, like silicon carbide, help reduce heat-induced stress, preserving chip quality. Thus, the interplay between these material properties and the dicing process necessitates careful optimization of cutting methods to ensure minimal defects and consistent chip performance.

Say

Let us participate in an activity to explore the unit a little more.

Activity

- Arrange the class in a semi-circle/circle.
- Each of us will tell the class their name, hometown, hobbies and special quality about themselves, starting with the 1st letter of their name. I will start with mine.
- Say your name aloud and start playing the game with your name.
- Say, “Now, each of one you shall continue with the game with your names till the last person in the circle/ semi-circle participates”.
- Listen to and watch the trainees while they play the game.
- Ask questions and clarify if you are unable to understand or hear a trainee.

Activity	Duration	Resources used
Ice Breaker		Pen, Notebook, etc.

Remember to:

- Discourage any queries related to one’s financial status, gender orientation or religious bias during the game.
- Try recognising each trainee by their name because it is not recommended for a trainer to ask the name of a trainee during every interaction

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Motivate participants to actively engage and share ideas within their groups, ensuring every member contributes.
- Walk around during discussions to offer insights or clarify concepts related to material properties and dicing techniques.
- During the debrief, highlight the importance of understanding material properties and process optimization in achieving high-quality outcomes.

Unit 1.2: Dicing Blade Selection and Safe Handling

Unit Objectives

At the end of this unit, the participants will be able to:

1. Explain the principles of selecting dicing blades based on wafer material and desired chip edge quality (smoothness, minimal chipping).
2. Compare and contrast different dicing blade types (diamond, abrasive) based on characteristics and suitability for various applications.
3. Describe safe handling procedures for dicing blades to minimize injury risks.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the principles of selecting dicing blades based on wafer material and chip edge quality requirements. We will compare different blade types, including diamond and abrasive blades, to understand their applications. Additionally, we will describe safe handling procedures to minimize injury risks during blade usage and maintenance.

Ask

Ask the participants the following questions:

- What are the key factors to consider when selecting a dicing blade for a specific wafer material?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Principles of Selecting Dicing Blades

Selecting the appropriate dicing blade depends on the wafer material and the desired chip edge quality. For brittle materials, blades with finer grit provide smooth edges and reduce chipping. Harder materials require diamond blades due to their ability to cut through high-hardness surfaces effectively. The blade thickness, bond type, and grit size must also be optimized to balance precision, cutting speed, and edge quality.

Comparison of Dicing Blade Types

- **Diamond Blades:** Diamond blades are renowned for their durability and precision, making them ideal for cutting hard and brittle materials such as silicon carbide and gallium nitride. These blades minimize tool wear, ensuring clean and precise cuts with minimal chipping, which is crucial for maintaining chip edge quality. Although they are more expensive, their long lifespan and superior performance make them the preferred choice for high-performance and critical applications. Their ability to handle challenging materials effectively reduces downtime and enhances overall productivity.
- **Abrasive Blades:** Abrasive blades are cost-effective and widely used for cutting softer materials like silicon. While they are suitable for general-purpose applications, they tend to cause more chipping and rough edges compared to diamond blades, which may affect chip quality. Abrasive blades wear out faster and require more frequent replacement, making them less suitable for high-volume or precision-intensive tasks. However, their affordability and availability make them a practical option for less demanding projects or when budget constraints are a priority.

Safe Handling Procedures for Dicing Blades

- To minimize injury risks, always wear appropriate personal protective equipment, such as gloves and safety goggles, when handling dicing blades. Store blades in protective covers to avoid accidental contact with sharp edges. During installation, ensure the blade is properly secured and aligned to prevent vibration or uneven cuts. Regularly inspect blades for wear or damage to avoid potential hazards during operation.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Selecting and Managing Dicing Blades for Optimal Performance
Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Blade characteristic cards (e.g., blade thickness, grit size, bond type)
- Wafer material scenario cards (described below)

Instructions:

1. Divide participants into groups and explain the activity objectives.
2. Provide a brief overview of dicing blade selection principles, blade types (diamond and abrasive), and safety protocols.
3. Distribute wafer material scenario cards (one per group). Each card describes a hypothetical situation requiring participants to choose the appropriate dicing blade and consider safety and quality requirements

Group Discussion and Planning (20 minutes):

Each group should analyze their scenario using the following prompts:

- What are the material properties of the wafer in this scenario?
- Which type of dicing blade (diamond or abrasive) is best suited for this material, and why?
- How can the team ensure smooth chip edges and minimal chipping?
- What safety measures should be prioritized when handling and using the selected blade

Group Presentations (20 minutes):

Each group will present their assigned scenario, analysis, and proposed blade selection and handling plan. Other groups can ask questions and offer alternative suggestions

Debriefing and Key Takeaways (20 minutes):

Facilitate a class discussion to summarize the activity. Key points to discuss:

- What factors influenced the choice of blade in each scenario?
- How did groups address chip quality and safety considerations?
- What insights were gained about the relationship between blade characteristics, wafer materials, and safety protocols?

Scenario Cards (Examples):

- **Scenario 1:** You are working with a brittle wafer material prone to chipping. Precision is critical for the application. Which blade would you choose and why?
- **Scenario 2:** The wafer material is soft but requires high production speed with minimal costs. How would you balance efficiency and cost while maintaining safety?
- **Scenario 3:** The task involves cutting a hard material with minimal edge defects. What blade type and grit size would ensure optimal results?

Activity	Duration	Resources used
Selecting and Managing Dicing Blades for Optimal Performance		Whiteboard or flipchart, Markers, Blade characteristic cards (e.g., blade thickness, grit size, bond type), Wafer material scenario cards (described below)

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Prompt participants to consider both technical factors (blade specifications) and practical concerns (safety and cost).
- Relate the scenarios to actual industrial challenges to make the activity more engaging.
- Highlight the importance of aligning blade selection with material properties and safety protocols for consistent chip quality and workplace safety.

Unit 1.3: Dicing EquipmentSetup, Calibration, and Record Keeping

Unit Objectives

At the end of this unit, the participants will be able to:

1. Summarize the standard operating procedures (SOPs) for dicing equipment setup and calibration.
2. Describe the functionality and purpose of critical dicing equipment components (stage, blade holder, vibration dampener).
3. Explain the importance of accurate record-keeping during equipment setup and calibration.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the standard operating procedures (SOPs) for setting up and calibrating dicing equipment, the functionality of critical components like the stage, blade holder, and vibration dampener, and the importance of accurate record-keeping during these processes. These topics will ensure a comprehensive understanding of maintaining precision and safety in the dicing process.

Ask

Ask the participants the following questions:

- Why is accurate calibration essential for the effective operation of dicing equipment?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

SOPs for Dicing Equipment Setup and Calibration

Standard operating procedures for dicing equipment setup involve thorough cleaning of all components, ensuring the blade is securely mounted and aligned, and calibrating the equipment for accurate cuts. Calibration checks include verifying the cutting depth, blade speed, and stage alignment. Operators must follow a step-by-step checklist to prevent errors, maintain safety, and ensure optimal cutting precision.

Functionality and Purpose of Critical Components

Critical components of dicing equipment play a pivotal role in ensuring precision and efficiency during the cutting process. The stage serves as the foundational platform that securely holds the wafer, facilitating stable and precise movements required for accurate dicing. Its ability to maintain consistent positioning is crucial for achieving uniform cuts and avoiding misalignment that could compromise the integrity of the chips. The blade holder is equally important, as it firmly secures the dicing blade in place, preventing any wobbling or displacement during operation.This stability ensures that the blade makes clean and accurate cuts, reducing the likelihood of chipping or defects. Additionally, the vibration dampener plays a key role in maintaining the quality of the cutting process by minimizing vibrations that can arise during high-speed operations

Importance of Accurate Record-Keeping

Accurate record-keeping during setup and calibration is vital for ensuring traceability, consistency, and adherence to quality standards in dicing operations. By meticulously documenting calibration settings, operators create a reliable reference that can be used to replicate successful processes, minimizing variability and errors in future tasks. Detailed records also play a critical role in identifying and resolving potential issues, as they provide a comprehensive history of equipment performance and adjustments. This practice not only enhances operational efficiency but also ensures compliance with industry standards and regulatory requirements. Moreover, accurate documentation supports troubleshooting by enabling technicians to pinpoint deviations from standard parameters, thereby reducing downtime and maintaining a safe working environment. Ultimately, systematic record-keeping contributes to the production of high-quality chips and promotes a culture of accountability and precision in the workplace.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Simulating Hotel Hierarchical Structures and Role Responsibilities

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards (described below)

Instructions:

1. Divide participants into groups and explain the activity objectives.
2. Provide a brief overview of the dicing process, including equipment setup, blade selection, and safety protocols.
3. Distribute scenario cards (one per group). Each card describes a hypothetical situation that could arise during the dicing process, requiring the group to consider various aspects such as blade selection, equipment calibration, and safety measures

Group Discussion and Planning (20 minutes):

Each group should analyze their scenario using the following prompts:

- What stage of the dicing process is impacted by this scenario (e.g., blade setup, calibration, cutting)?
- How might this scenario impact chip quality (smoothness, minimal chipping)?
- What safety protocols should be considered to prevent injury and equipment damage?
- What actions or adjustments should be made to ensure optimal results, including maintaining equipment efficiency and ensuring the safety of workers?

Group Presentations (20 minutes):

Each group will present their scenario, analysis, and proposed solutions to the rest of the class. Other groups can ask questions, suggest alternatives, and engage in a discussion.

Debriefing and Key Takeaways (20 minutes):

Facilitate a class discussion to debrief on the activity. Key points to consider:

- What approaches did each group take to address the scenario effectively?
- How did safety and efficiency considerations influence their decisions?
- What were the key learnings from the activity regarding equipment handling, blade selection, and safety in the dicing process?

Scenario Cards (Examples):

- **Scenario 1:**During a routine dicing operation, you notice the blade is showing signs of wear. The wafer material being cut is silicon, which requires high precision. What steps will you take to assess the blade condition and ensure quality cuts while maintaining safety?
- **Scenario 2:** The dicing machine is making unusual noises, possibly indicating misalignment or an issue with the vibration dampeners. How would you address the issue to ensure smooth operation without compromising chip quality or safety?
- **Scenario 3:** During a high-volume production run, the team encounters a minor chip defect in several wafers. The blade is properly aligned, but chip quality is inconsistent. What adjustments would you make to the equipment settings, and how would you communicate the need for corrective action to the team?

Activity	Duration	Resources used
Dicing Process Simulation with Focus on Safety and Efficiency		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below)

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Remind participants that safety should always be the first priority when dealing with machinery and dicing blades. Ensure that their proposed solutions account for potential risks and hazards.
- Encourage the teams to think critically about how different factors (e.g., equipment wear, material properties, calibration) influence the overall outcome. Collaboration within the group is key to coming up with comprehensive solutions.
- Relate scenarios to real-life experiences, helping participants understand the implications of their decisions on both the quality of the chips and the safety of the production environment

Unit 1.4: Dicing Parameters and Their Influence on Process Efficiency

Unit Objectives

At the end of this unit, the participants will be able to:

1. Define and explain key dicing parameters (speed, force, blade selection) and their impact on throughput, chip quality, and blade wear.
2. Adjust dicing parameters based on process data and wafer inspection results.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the essential parameters of the dicing process, including speed, force, and blade selection, and their influence on production efficiency, chip quality, and blade lifespan. Additionally, we will explore how to adjust these parameters using process data and inspection results to optimize outcomes. This unit aims to provide practical insights into maintaining precision and efficiency in dicing operations

Ask

Ask the participants the following questions:

- What are the key parameters involved in the dicing process, and why are they important?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Key Dicing Parameters and Their Impact

- **Speed**: Dicing speed affects both throughput and chip quality. Higher speeds increase throughput but may lead to poor cut quality or edge chipping if not properly managed. Lower speeds can improve precision but may reduce productivity.
- **Force**: Applied force directly impacts blade wear and chip integrity. Excessive force can accelerate blade wear and cause cracks in chips, while insufficient force may result in incomplete cuts or poor alignment.

- **Blade Selection:** The type of blade determines the quality of the cut and its durability. Factors like blade grit, material, and thickness should align with the wafer's material and thickness to ensure smooth operations and reduced blade wear

Adjusting Dicing Parameters

The process of adjusting dicing parameters is critical for achieving optimal results in wafer dicing operations. This involves analyzing process data and inspecting wafers to identify any deviations in performance, such as increased blade wear, poor chip quality, or reduced throughput. By interpreting these insights, parameters like speed, force, and blade type can be fine-tuned to address specific issues. For example, if inspections reveal edge chipping, reducing the dicing speed or force can help improve precision and minimize damage. Similarly, process data indicating high blade wear may require selecting a more durable blade or adjusting the cutting force. This continuous adjustment ensures consistent quality, prolongs blade life, and maintains efficiency in production.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Optimizing Dicing Parameters for Precision and Efficiency

Group Size: 4–6 participants

Materials: Group Activity: Optimizing Dicing Parameters for Precision and Efficiency

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards (described below)

Instructions:

Divide participants into groups.
Form groups of 4–6 participants each and distribute materials.

Explain the activity objectives.
Introduce the importance of optimizing dicing parameters for throughput, chip quality, and blade wear. Emphasize the role of analytical thinking and collaborative problem-solving in addressing challenges.

Distribute scenario cards (one per group).
Each scenario card will describe a hypothetical situation involving dicing process challenges. These scenarios will prompt participants to evaluate and adjust dicing parameters based on process data and inspection results.

Activity Structure:

Group Discussion and Planning (20 minutes):
Groups will discuss their assigned scenarios using the following prompts:

- What dicing parameters are most critical in this scenario?
- How do process data and inspection results guide adjustments?
- What solutions can be implemented to optimize the process?

Group Presentations (20 minutes):
Each group will present their scenario, analysis, and proposed solutions to the class. Encourage question and constructive feedback from other groups.

Debriefing and Key Takeaways (20 minutes):

Facilitate a class discussion to reflect on the activity. Highlight key insights, compare approaches, and discuss the importance of parameter adjustments in real-world scenarios.

Scenario Cards (Examples):

- **Scenario 1**: Inspection data shows an increase in edge chipping during high-speed dicing. Adjustments are needed to improve chip quality while maintaining throughput.
- **Scenario 2:** The blade shows signs of accelerated wear, reducing cutting efficiency. Discuss solutions to optimize blade life without compromising production.
- **Scenario 3:** Wafer inspection reveals incomplete cuts in certain areas. Identify the parameters to adjust and strategies to ensure cutting precision.

Activity	Duration	Resources used
Optimizing Dicing Parameters for Precision and Efficiency		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below)

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Encourage groups to think critically and use both technical knowledge and teamwork skills to address the scenarios.
- Prompt groups to consider both immediate and long-term implications of their solutions on efficiency, quality, and blade wear.
- During the debriefing, highlight how different solutions reflect diverse approaches to problem-solving and process optimization.

Unit 1.5: Facilities and Amenities in the Hospitality Industry

Unit Objectives

At the end of this unit, the participants will be able to:

1. Demonstrate techniques for visual inspection of diced wafers to identify chip damage and edge quality issues.
2. Utilize data analysis techniques to identify correlations between dicing parameters, chip quality, and throughput.
3. Apply iterative optimization principles to balance throughput with minimal chip damage.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the techniques for visually inspecting diced wafers to detect chip damage and edge quality issues. We will explore how data analysis helps identify relationships between dicing parameters and chip quality. Additionally, we will study iterative optimization methods to achieve a balance between high throughput and minimal chip damage, ensuring efficiency and quality in the dicing process.

Ask

Ask the participants the following questions:

- Why is visual inspection important in the dicing process, and how does it influence chip quality?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Techniques for Visual Inspection of Diced Wafers

- **Microscopic Examination**: Use high-magnification optical or electron microscopes to inspect wafer edges and chip surfaces for cracks, chipping, and irregularities. This provides a detailed view of defects invisible to the naked eye.
- **Automated Inspection Systems:** Employ advanced imaging systems equipped with machine learning algorithms to scan diced wafers quickly and accurately. These systems can detect

defects and classify them for further analysis.

- **Edge Quality Analysis**: Assess the wafer's edge integrity by observing the uniformity of cuts, checking for jagged edges, or signs of chipping that might affect functionality or assembly.
- **Light Refraction and Reflection Tests**: Use light-based techniques to identify imperfections. Variations in light patterns indicate potential surface issues or irregularities in the diced edges.
- **Defect Mapping:** Create a defect map using software to document the location, type, and severity of defects. This provides a comprehensive overview for quality control and parameter adjustments.
- **Cross-Sectional Analysis**: Perform a cross-sectional inspection of selected wafers to evaluate cut depth and confirm alignment accuracy. This ensures the dicing process maintains precision standards

Utilizing Data Analysis Techniques

Data analysis plays a crucial role in optimizing the dicing process by identifying patterns and relationships between parameters such as speed and force and their effects on chip quality. Through the analysis of metrics like defect rates, blade wear, and throughput, manufacturers can uncover insights that guide precise adjustments to dicing parameters. This enables a balance between achieving high efficiency and maintaining minimal defects. By leveraging data, the process becomes more predictable and efficient, ensuring consistent quality and performance.

Applying Iterative Optimization Principles

Applying iterative optimization principles involves continuously improving dicing parameters through a systematic process of adjustment, testing, and analysis. Each iteration evaluates the impact of changes on throughput and chip quality, allowing for incremental refinements. This approach helps identify the optimal combination of parameters that maximize production efficiency while minimizing defects and blade wear. By repeating this cycle, manufacturers can adapt to changing conditions, ensure consistent product quality, and achieve cost-effective operations.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Optimizing Dicing Parameters and Ensuring Wafer Quality
Group Size: 4–6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards (one per group)

Instructions

Group Formation:

Divide participants into groups of 4–6 and provide them with the materials.

Objective Overview:

Explain that the goal is to simulate decision-making for optimizing dicing parameters while addressing chip quality issues. Emphasize teamwork, problem-solving, and data-driven decisions.

Scenario Distribution:
Provide each group with a scenario card describing a challenge in the wafer dicing process. These scenarios will require analyzing issues and proposing adjustments to parameters like speed, force, or blade type to balance throughput and quality.

Group Discussion and Planning (20 minutes):
Groups will discuss their scenarios using these prompts:

- What aspect of the dicing process is affected in this scenario?
- What data or inspection results guide the adjustments?
- How can the process be optimized to address the issue effectively?

Group Presentations (20 minutes):

Each group will present their scenario, analysis, and proposed solutions to the class. Other groups are encouraged to ask questions or suggest improvements.

Debriefing and Key Takeaways (20 minutes):

Facilitate a class discussion on:

- The different approaches taken by each group to optimize the process.
- The role of data analysis and inspection in guiding decisions.
- Lessons learned about balancing efficiency with chip quality.

Scenario Cards (Examples):

- **Scenario 1**: Inspection shows uneven cuts and edge chipping on several wafers. How would you adjust speed and force to resolve the issue while maintaining throughput?
- **Scenario 2:** Blade wear is causing incomplete cuts and delays in production. What changes would you make to blade selection or parameters to improve performance?
- **Scenario 3:** A sudden increase in defect rates is detected after increasing dicing speed for higher throughput. How would you address the problem to restore quality?

Activity	Duration	Resources used
Optimizing Dicing Parameters and Ensuring Wafer Quality		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Encourage participants to focus on data-driven solutions and explain the rationale behind their decisions.
- Guide groups to think holistically, considering not just the immediate fixes but also the long-term implications of their adjustments.
- During the debrief, summarize how iterative optimization and inspection techniques play critical roles in maintaining production quality and efficiency.

Unit 1.6: Preventive Maintenance and Continuous Monitoring

Unit Objectives

At the end of this unit, the participants will be able to:

1. Record and analyze critical dicing process data (parameters, yield results, cycle time) to identify performance trends.
2. Correlate blade wear data with maintenance needs and plan preventive maintenance activities accordingly.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the importance of recording and analyzing dicing process data to improve efficiency and quality. Topics will include identifying trends from process data, the role of blade wear monitoring, and strategies for planning preventive maintenance to enhance operational reliability and performance.

Ask

Ask the participants the following questions:

- Why is it important to monitor and analyze dicing process data regularly?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Recording and Analyzing Critical Dicing Process Data

- **Recording Critical Dicing Process Data:**

  The process of recording data such as dicing parameters, yield results, and cycle times is essential for gaining a comprehensive understanding of the production workflow. This data serves as the foundation for identifying areas of improvement, tracking performance, and ensuring that the dicing process meets quality standards consistently. Accurate and detailed records provide a clear picture of operational efficiency over time.

- **Analyzing Dicing Process Data**:

  Analyzing the collected data involves identifying patterns, trends, and correlations that impact overall performance. By examining metrics like defect rates and throughput, inefficiencies or bottlenecks in the process can be detected. Data analysis helps manufacturers make informed decisions to optimize production settings, improve yields, and minimize errors, leading to cost-effective operations.

Optimizing Performance Through Data:

With a data-driven approach, adjustments to dicing parameters can be made to enhance both throughput and chip quality. By continuously monitoring and analyzing the data, businesses can refine their processes, achieve consistent results, and reduce production costs while maintaining high-quality output.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Optimizing Dicing Parameters and Wafer Quality

I Focus: Collaborative problem-solving to balance throughput, chip quality, and blade wear using process data.

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards

Instructions

Divide Participants into Groups:

Split the participants into groups and explain the activity objectives, focusing on data-driven decision-making and optimization techniques.

Review Key Concepts:

Briefly explain dicing parameters (speed, force, blade selection), chip quality considerations, and preventive maintenance principles.

Distribute Scenario Cards:

Each group receives a card describing a unique dicing-related challenge. Scenarios should introduce realistic issues that require analysis of process data to find solutions.

Group Discussion and Planning (20 minutes):

Groups discuss the scenario using these prompts:

- What data is critical for analyzing this challenge?
- How can dicing parameters be adjusted to address the issue?
- What steps should be taken to ensure quality and efficiency?

Group Presentations (20 minutes):

Each group presents their scenario, analysis, and proposed solutions. Other groups are encouraged to ask questions and provide feedback.

Debriefing and Key Takeaways (20 minutes):

Lead a discussion highlighting:

- Different approaches used by groups.
- How data influenced decisions.
- Key learnings about balancing throughput, quality, and maintenance

Scenario Cards (Examples):

- **Scenario 1:** An increase in chip defects is observed at a specific dicing speed. Analyze data to recommend adjustments to improve yield.
- **Scenario 2:** Blade wear is affecting throughput, and no immediate replacement is available. Propose solutions to balance performance with quality until maintenance can be scheduled.
- **Scenario 3:** Throughput goals are not being met due to cycle time inefficiencies. Use process data to identify and address bottlenecks.

Activity	Duration	Resources used
Optimizing Dicing Parameters and Wafer Quality		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards etc

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Ensure each group member actively participates by assigning roles (e.g., data analyst, process engineer, presenter).
- Emphasize the importance of using data to support their decisions and propose actionable solutions.
- During presentations and debriefing, create an open environment where participants feel comfortable sharing diverse perspectives

Exercise

1. Which property of wafer material significantly impacts the dicing process?
    a) Electrical conductivity
    b) Hardness and brittleness
    c) Color and density
    d) Melting point

    Answer: b) Hardness and brittleness

2. What is the primary advantage of using diamond dicing blades?
    a) Cost-effectiveness
    b) Compatibility with all equipment
    c) Superior cutting precision and durability
    d) Reduced maintenance requirements

    Answer: c) Superior cutting precision and durability

3. What is the purpose of a vibration dampener in dicing equipment?
    a) To enhance blade sharpness
    b) To reduce wear on the blade
    c) To minimize vibrations for precise cutting
    d) To increase dicing speed

    Answer: c) To minimize vibrations for precise cutting

4. Which of the following is a key factor influencing blade selection for wafer dicing?
    a) Chip size
    b) Wafer material
    c) Blade color
    d) Operator experience

    Answer: b) Wafer material

Fill in the Blanks

1. ________ is the primary dicing parameter that affects chip quality, throughput, and blade wear.

    Answer: Blade selection

2. The ________ is responsible for holding and guiding the wafer during the dicing process.

    Answer: Stage

3. Accurate record-keeping during equipmeWnt setup and calibration ensures consistent ________.

    Answer: Quality

4. The ________ process involves adjusting parameters like speed and force to optimize chip quality while maintaining high throughput.

   Answer: Iterative optimization.

1. Match the Following

Column A	Column B
Silicon carbide wafers	a. Identifies cracks and edge chipping
Blade wear indicators	b. Preventive maintenance planning
Dicing blade tension	c. Affects cutting performance and chip quality
Visual wafer inspection	d. Harder and more brittle material

Answers:1-d, 2-b, 3-c, 4-a

2. Match the following:

Column A	Column B
Diamond dicing blades	a. Ensure consistent equipment setup
Wafer design layout	b. Identifies correlations for optimization
Standard Operating Procedures (SOPs)	c. Suitable for hard materials
Process data analysis	d. Determines chip dimensions and spacing

Answers:1-c, 2-d, 3-a, 4-b

Telecom Sector Skill Council

2. Dicing Blade Selection & Inventory Management

Unit 2.1: Dicing Blade Selection and Specifications
Unit 2.2: Dicing Blade Inspection and Wear Detection
Unit 2.3: Dicing Blade Maintenance and Inventory Management
Unit 2.4: Storage, Handling, and Disposal of Dicing Blades
Unit 2.5: Blade Wear Monitoring and Process Optimization

TEL/N7213

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Explain the impact of wafer thickness on blade selection and potential chip edge quality issues.
2. Explain the importance of establishing a routine inspection schedule for dicing blades as per manufacturer's recommendations or company SOPs.
3. Identify signs of wear and tear on dicing blades (chipped segments, reduced diameter, blade glazing) that may affect cutting performance.
4. Explain the proper use of inspection tools (magnifying glass, blade wear gauge) for detailed blade examination.
5. Explain the importance of documenting inspection findings and blade condition (usable, requires replacement) for tracking purposes.
6. Explain the principles of inventory management, including establishing minimum and maximum inventory levels based on usage patterns and lead times.
7. Explain the importance of proper storage conditions for dicing blades (humidity control, dust-free environment) to maintain optimal performance and lifespan.
8. Describe safe and environmentally responsible disposal procedures for used or worn-out dicing blades.
9. Demonstrate gathering key information from wafer specification documents (material datasheet, chip design layout) to determine blade selection criteria, excluding wafer material properties.
10. Identify the wafer material composition, thickness, and desired chip size from the specifications.
11. Select the appropriate dicing blade type (e.g., diamond, abrasive) considering compatibility, cost-effectiveness, and desired cutting performance.
12. Demonstrate the proper use of inspection tools (magnifying glass, blade wear gauge) to examine dicing blades for signs of wear and tear.
13. Utilize designated tracking systems (e.g., inventory management software, physical inventory checks) to monitor current blade inventory levels (quantity, type).
14. Initiate blade procurement processes (purchase orders) to ensure sufficient stock before depletion, when inventory levels fall below the minimum threshold.
15. Demonstrate how to safely handle dicing blades during inventory management activities (receiving, storing, issuing) following proper procedures.

Unit 2.1: Dicing Blade Selection and Specifications

Unit Objectives

At the end of this unit, the participants will be able to:

1. Demonstrate how to gather key information from wafer specification documents (material datasheet, chip design layout) to determine blade selection criteria.
2. Identify wafer material composition, thickness, and desired chip size from the specifications.
3. Select the appropriate dicing blade type (diamond, abrasive) based on compatibility, cost-effectiveness, and desired cutting performance.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss how to gather key information from wafer specification documents to determine the appropriate dicing blade selection. We will cover how to identify wafer material composition, thickness, and chip size from the specifications. Additionally, we will explore how to select the most suitable dicing blade type, considering compatibility, cost-effectiveness, and cutting performance.

Ask

Ask the participants the following questions:

- How does the material composition of a wafer influence the choice of dicing blade?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Key Information from Wafer Specifications

To ensure the proper selection of a dicing blade, it's essential to thoroughly examine wafer specification documents, which include material datasheets and chip design layouts. These documents provide crucial information regarding the wafer's material properties, thickness, and chip design, all of which influence the choice of blade. By analyzing these details, one can determine the appropriate blade for achieving the desired results, ensuring compatibility and optimal performance during the dicing process.

Identifying Wafer Material Composition and Desired Chip Size

The material composition of the wafer plays a significant role in determining which dicing blade will be most effective. Harder materials, such as silicon carbide, require stronger and more durable blades, while softer materials may require a different blade type. Additionally, understanding the wafer's thickness and the desired chip size from the specifications helps ensure the blade is suitable for cutting without damaging the wafer or chips. This allows for precision cuts that meet the required specifications while minimizing waste and defects.

Selecting Dicing Blade Type

Selecting the right dicing blade is critical for achieving the desired cutting performance. Factors such as the material's hardness, brittleness, and thickness directly affect blade selection. Diamond blades are commonly chosen for tougher materials due to their durability and cutting precision, while abrasive blades are better suited for less rigid materials. Additionally, cost-effectiveness and the blade's overall cutting performance must be considered, balancing the need for efficiency with budget constraints. Proper blade selection ensures both the quality and cost-effectiveness of the production process.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Dicing Process Optimization with a Focus on Blade Selection, Safety, and Employee Engagement

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards (described below)

Instructions:

1. **Divide participants into groups**: Explain the activity objectives, including the importance of proper blade selection, safe handling of dicing equipment, and how these factors contribute to both the production process and employee engagement.
2. **Brief Overview:** Provide a short review of the dicing process, including wafer material properties, dicing blade types, and key safety protocols for handling equipment.
3. **Distribute Scenario Cards:** Each group will receive a scenario card that describes a potential situation in the dicing process. The scenario will focus on blade selection, process optimization, and safety.

Group Discussion and Planning (20 minutes):

Each group should discuss the scenario, considering the following:

- What stage of the dicing process is impacted by this scenario?

- How might the blade selection and process optimization affect employee engagement?
- What safety protocols should be followed to address this scenario?
- As a team, propose a solution or action plan that optimizes the process, improves engagement, and ensures safety.

Group Presentations (20 minutes):

Each group will present their scenario analysis and proposed solutions to the rest of the class. Encourage open discussion and questions from other groups.

Debriefing and Key Takeaways (20 minutes):

Facilitate a class-wide discussion on the following key points:

- How did different groups approach the scenario?
- How did blade selection, safety, and employee engagement factors influence the groups' decisions?
- What are the main takeaways regarding the dicing process, safety, and the importance of employee engagement in achieving optimal outcomes?

Examples of Scenario Cards :

- **Scenario 1:** You are tasked with selecting a blade for a new wafer material that is significantly harder than typical materials used in production. The blade selection needs to ensure minimal chip damage and high throughput. How would you approach this situation while ensuring that safety protocols are followed and employee engagement remains a priority?
- **Scenario 2:** During the dicing process, a blade starts to show significant wear, leading to reduced chip quality and slower throughput. You need to address this issue promptly while maintaining a safe working environment and minimizing disruption to the team. How would you handle this situation while maintaining employee morale and adherence to safety procedures?
- **Scenario 3:** A new team member has joined the production team and is not yet fully familiar with the dicing equipment and safety protocols. How would you ensure that they are trained effectively and safely, while also maintaining high productivity and employee engagement?

Activity	Duration	Resources used
Dicing Process Optimization with a Focus on Blade Selection, Safety, and Employee		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below)

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Stress the importance of using sales data, customer behavior, and market research for accurate customer segmentation. Highlight past sales as a tool for identifying effective customer groups.
- Show how segmentation shapes menu choices. For instance, health-conscious customers need plant-based options, while families might prefer comfort food or value meals, driving sales and satisfaction.
- Discuss balancing diverse customer needs with cost efficiency, menu cohesion, and strategic marketing opportunities through segmentation.

Unit 2.2: Dicing Blade Inspection and Wear Detection

Unit Objectives

At the end of this unit, the participants will be able to:

1. Explain the impact of wafer thickness on blade selection and potential chip edge quality issues.
2. Identify signs of wear and tear on dicing blades (chipped segments, reduced diameter, blade glazing) that may affect cutting performance.
3. Demonstrate the proper use of inspection tools (magnifying glass, blade wear gauge) to examine dicing blades for signs of wear.
4. Explain the importance of documenting inspection findings and blade condition (usable, requires replacement) for tracking purposes.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the factors that influence blade selection based on wafer thickness, how to identify signs of wear and tear on dicing blades, the proper use of inspection tools, and the importance of documenting blade conditions. We will explore how these elements ensure optimal cutting performance and maintain quality in the dicing process.

Ask

Ask the participants the following questions:

- How does the thickness of the wafer affect the selection of the appropriate dicing blade?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Impact of Wafer Thickness on Blade Selection and Chip Edge Quality:
The thickness of the wafer significantly affects the choice of the dicing blade. Thicker wafers require a blade that can handle the increased force during the cutting process without compromising the integrity of the wafer. Thin wafers, on the other hand, may require blades that minimize the risk of chipping or cracking. If the blade is not appropriately selected for the wafer thickness, issues like poor edge quality, excessive chipping, or incomplete cuts may arise, which could affect the overall yield and quality of the product.

Signs of Wear and Tear on Dicing Blades

- **Chipped Segments**: Over time, dicing blades can develop chips or cracks on their edges due to constant contact with the wafer material. These chips can lead to uneven cutting, causing defects in the wafer and reducing the overall chip quality. Chipped blades are less effective and can create unwanted stress on the material being cut.
- **Reduced Diameter:** As a blade is used, its diameter gradually decreases due to the wear and tear of the cutting surface. A smaller diameter blade may not perform as efficiently, resulting in slower cutting speeds and a higher chance of inconsistent or incomplete cuts. This can cause delays in production and a lower yield.
- **Blade Glazing:** Blade glazing occurs when the surface of the dicing blade becomes covered with a layer of material from the wafer. This can result in reduced cutting efficiency, as the blade's ability to cut through the material diminishes. Glazed blades may generate excess heat, increasing the risk of wafer damage and impacting chip quality.
- **Decreased Cutting Efficiency:** Worn blades struggle to maintain their original cutting performance. As wear progresses, the blade may exert inconsistent pressure on the wafer, leading to irregular cuts and poor edge quality. This inconsistency can affect the precision required in high-quality wafer production.
- **Increased Cycle Time**: When dicing blades are worn, more time is required to complete the cutting process. The reduced effectiveness of the blade increases the time needed for each cut, which can lead to higher operational costs and delays in production timelines.
- **Potential Damage to Wafer:** Worn-out blades are more likely to cause damage to the wafer during cutting. This damage may manifest as cracks, chips, or incomplete cuts, compromising the integrity of the final product and increasing the risk of material wastage.

Regular inspection and monitoring of dicing blades for these signs of wear and tear are critical to ensuring optimal cutting performance, minimizing material damage, and maintaining consistent production quality.

Proper Use of Inspection Tools to Examine Dicing Blades:

Using inspection tools such as magnifying glasses and blade wear gauges is essential for identifying signs of wear and tear on dicing blades. A magnifying glass helps to detect small cracks or chips in the blade, while a blade wear gauge measures the blade's diameter and helps identify any reduction in size that may affect performance. These tools ensure that the blade is in optimal condition and ready for use.

Importance of Documenting Inspection Findings:

Documenting the findings from blade inspections is crucial for tracking the condition of the blade over time. Recording whether a blade is still usable or requires replacement helps maintain a consistent level of performance and ensures that the necessary maintenance or replacements are carried out promptly. Proper documentation also helps in tracking patterns of wear and tear, which can inform future decisions regarding blade selection and maintenance schedules.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Analyzing Dicing Process Optimization with Focus on Blade Selection and Maintenance

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards (described below)

Instructions:

Introduction (10 minutes):

- Divide participants into groups.
- Briefly introduce the dicing process, the role of blade selection, and the impact of blade wear on the production process.
- Explain the importance of optimizing the dicing process for improved throughput, reduced waste, and maintaining chip quality.

Distribute Scenario Cards (5 minutes):

Provide each group with a scenario card that presents a challenge related to blade selection or blade maintenance in the dicing process.

Group Discussion and Planning (20 minutes):

Each group should discuss the scenario using the following prompts:

- What stage of the dicing process is impacted by the issue in this scenario?
- How might this issue affect chip quality, throughput, or blade wear?
- What blade selection or maintenance actions can be taken to address this challenge?
- How would you document the findings of blade wear or performance for future optimization?

Group Presentations (15 minutes):

- Each group will present their scenario, analysis, and proposed solutions to the rest of the class.
- Encourage questions and discussions from other groups, fostering a collaborative approach.

Debriefing and Key Takeaways (10 minutes):

- Facilitate a class discussion on the activity outcomes.
- Key points to consider:
  - What were the various approaches to optimizing the dicing process?
  - How did blade selection and maintenance influence the decision-making process?
  - What are some key takeaways regarding effective blade monitoring and optimization?

Scenario Cards (Examples):

- **Scenario 1:** During a routine dicing run, you notice a decrease in throughput and an increase in cycle time. The quality of the chips is also deteriorating with more chipping and edge damage. Upon inspecting the blade, you find that its diameter has reduced slightly. What actions will you take to address the situation, and how would you document this blade condition?
- **Scenario 2**: A technician observes that the dicing blade is showing signs of glazing. As a result, the blade is not cutting effectively and causing more wear on both the blade and the wafer. What steps would you take to remedy the situation, and how will you monitor the blade's performance in future runs?
- **Scenario 3**: The production manager requests a more cost-effective solution for blade selection while maintaining chip quality. You have the option to choose between a diamond blade and an abrasive blade. Based on wafer material composition, thickness, and expected chip quality, how will you make your decision?

Activity	Duration	Resources used
Analyzing Dicing Process Optimization with Focus on Blade Selection and Maintenance		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Ensure participants understand how to identify key signs of blade wear (e.g., chipped segments, reduced diameter, glazing) and how these can impact the dicing process.
- Emphasize the importance of using data (e.g., throughput, cycle time, blade wear indicators) in making informed decisions regarding blade selection and maintenance.
- Stress the significance of accurately documenting blade wear and performance data to track trends and optimize the dicing process for future runs.

Unit 2.3: Dicing Blade Maintenance and Inventory Management UnitManagement

Unit Objectives

At the end of this unit, the participants will be able to:

1. importance of establishing a routine inspection schedule for dicing blades as per the manufacturer's recommendations or company SOPs.
2. Explain the principles of inventory management, including establishing minimum and maximum inventory levels based on usage patterns and lead times.
3. Utilize designated tracking systems (e.g., inventory management software, physical inventory checks) to monitor current blade inventory levels (quantity, type).
4. Initiate blade procurement processes (purchase orders) to ensure sufficient stock before depletion when inventory levels fall below the minimum threshold.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the importance of establishing a routine inspection schedule for dicing blades, inventory management principles, and the use of tracking systems to monitor blade stock. We will also cover the process of initiating blade procurement to ensure uninterrupted production. These concepts are crucial for maintaining efficiency in the dicing process and preventing disruptions caused by inventory shortages

Ask

Ask the participants the following questions:

- Why is it important to establish a routine inspection schedule and proper inventory management for dicing blades in production?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Establishing a Routine Inspection Schedule for Dicing Blades:
Maintaining a routine inspection schedule for dicing blades is crucial to ensure optimal performance and longevity. Following manufacturer recommendations or company Standard Operating Procedures (SOPs) allows for timely detection of wear and tear, which can prevent costly downtime and reduce the risk of poor chip quality. A consistent inspection routine helps to maintain production efficiency, minimize blade-related issues, and ensure that blades are replaced or maintained before they cause significant disruptions.

Principles of Inventory Management:

Effective inventory management involves establishing minimum and maximum inventory levels based on usage patterns and lead times. By tracking usage rates and understanding the time required to replenish stock, a company can avoid both overstocking and stockouts. Minimum inventory levels ensure that there is always a sufficient supply of dicing blades available, while maximum levels help prevent excessive inventory that ties up capital and storage space. Proper inventory management ensures that blades are available when needed, without overburdening resources.

Utilizing Tracking Systems for Blade Inventory:

Tracking systems such as inventory management software or physical inventory checks are essential for monitoring dicing blade inventory levels. These systems provide real-time information on the quantity and type of blades in stock, enabling the management team to make informed decisions about reordering or maintaining stock levels. Utilizing these systems helps in optimizing inventory control, reducing the chances of running out of essential blades, and ensuring smooth production operations.

Initiating Blade Procurement Processes:

When inventory levels fall below the minimum threshold, it is necessary to initiate the procurement process to ensure a continuous supply of blades. This involves placing purchase orders with suppliers, tracking order status, and ensuring that the blades arrive before stock is completely depleted. Timely procurement is essential for avoiding production delays and maintaining a steady workflow in the dicing process.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity:: Dicing Blade Inventory Management and Procurement Simulation

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards (described below)

Instructions:

1. Divide participants into groups of 4-6.
2. Explain the activity objectives: The goal is to simulate the process of managing dicing blade inventory, performing routine inspections, and initiating procurement to ensure a smooth production process.
3. Briefly review the importance of blade inspection, inventory management, and procurement processes, as well as how these are crucial for maintaining optimal production efficiency.

4. Distribute scenario cards (one per group). Each card will describe a hypothetical situation involving blade wear, inventory levels, or procurement challenges that the group needs to solve.
5. Encourage each group to discuss their scenario and come up with solutions that focus on managing blade inventory and ensuring procurement processes are timely, efficient, and aligned with production needs.

Group Discussion and Planning (20 minutes):

- Each group should analyze the scenario by considering:
  - How can they monitor blade wear and prevent production delays due to worn-out blades?
  - What inventory management techniques can they use to ensure that sufficient stock levels are maintained?
  - How can they address any procurement delays or shortages in blade inventory?
  - How would the team ensure proper documentation of blade condition and procurement processes?

Group Presentations (20 minutes):

- Each group will present their scenario, analysis, and proposed solutions to the rest of the class.
- Encourage questions and discussions from other groups to compare solutions and share insights.

Debriefing and Key Takeaways (20 minutes):

- Facilitate a class discussion to debrief the activity.
- Key points to consider:
  - How did each group approach the inventory and procurement challenges?
  - How did they ensure timely procurement of dicing blades while considering production demands and lead times?
  - What key learnings did participants gain about the relationship between blade wear, inventory management, and production efficiency?

Examples of Scenario Cards :

- **Scenario 1**: You are managing the inventory of dicing blades. The stock has fallen below the minimum threshold for the most used blade type, but the next shipment is delayed by a week. How would you address this issue, ensuring that there is no disruption in production while waiting for the new order?
- **Scenario** 2: During a routine inspection of the dicing blades, you notice that several blades show signs of glazing and reduced performance. You need to continue production while addressing this issue. How do you manage the blade wear and prevent production delays?
- **Scenario 3**: The company has experienced a sudden increase in blade usage due to an unexpected spike in production demand. The procurement process is slow, and you're concerned about running out of stock. How would you expedite the procurement process and communicate with the team about potential impacts?

Activity	Duration	Resources used
Dicing Blade Inventory Management and Procurement Simulation		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Ask participants to think about how they would approach these challenges in a real-world setting. What tools or systems could they use to track inventory levels and blade wear?
- The activity is designed to simulate teamwork and decision-making. Emphasize the importance of collaboration, as groups will need to consider different perspectives, including blade wear, production schedules, and inventory management.
- Encourage groups to not only solve the problem at hand but also propose ways to optimize existing processes for better blade management and procurement efficiency.

Unit 2.4: Storage, Handling, and Disposal of Dicing Blades

Unit Objectives

At the end of this unit, the participants will be able to:

1. Explain the importance of proper storage conditions for dicing blades (humidity control, dust-free environment) to maintain optimal performance and lifespan.
2. Demonstrate how to safely handle dicing blades during inventory management activities (receiving, storing, issuing) following proper procedures.
3. Describe safe and environmentally responsible disposal procedures for used or worn-out dicing blades.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the proper handling, storage, and disposal of dicing blades to ensure their optimal performance and safe management. You will learn how to maintain the integrity and lifespan of blades through correct storage conditions, handle them safely during inventory activities, and follow environmentally responsible disposal procedures when they are no longer usable.

Ask

Ask the participants the following questions:

- Why is it important to store dicing blades in a dust-free and humidity-controlled environment?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Importance of Proper Storage Conditions for Dicing Blades: Proper storage conditions are crucial for maintaining the performance and lifespan of dicing blades. Dicing blades should be stored in a dust-free environment to prevent contamination that could affect cutting quality. Additionally, humidity control is essential to avoid moisture-related damage, such as rusting or blade corrosion. By ensuring these optimal storage conditions, the blades can retain their precision, sharpness, and efficiency, ultimately extending their useful life.

Safe Handling of Dicing Blades During Inventory Management Activities: Handling dicing blades safely is vital to prevent damage to the blades and avoid injury to personnel. During inventory management activities such as receiving, storing, and issuing blades, it is important to follow established procedures. This includes using appropriate protective equipment, such as gloves, and ensuring the blades are stored securely in their designated locations. Proper handling prevents the blades from becoming damaged or contaminated, maintaining their effectiveness in the production process.

Safe and Environmentally Responsible Disposal of Used or Worn-out Dicing Blades: Used or worn-out dicing blades should be disposed of safely and in an environmentally responsible manner. This involves following established disposal procedures to minimize environmental impact and ensure the safety of personnel. The blades may need to be collected, stored separately, and disposed of through authorized recycling or waste management services. Proper disposal ensures compliance with safety regulations and helps reduce the risk of environmental harm caused by improper handling.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Simulating a Dicing Blade Inventory Management Scenario with a Focus on Safety, Handling, and Efficiency

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart,
- Markers,
- Sticky notes (different colors),
- Scenario cards

Instructions:

1. **Introduction**: Divide participants into small groups. Briefly explain the importance of proper dicing blade inventory management, handling, and disposal for maintaining blade performance and ensuring workplace safety. Discuss safe handling, proper storage conditions, and disposal procedures for dicing blades.
2. **Scenario Cards:** Distribute scenario cards (one per group). Each card will describe a hypothetical situation involving dicing blade management. The group will need to discuss the challenge and determine the best course of action to address it, ensuring safety, performance, and efficiency.
3. **Group Discussion and Planning (20 minutes)**: Each group should discuss the scenario using the following prompts:
    1. What part of the dicing blade inventory management process is impacted by this situation (e.g., storage, handling, disposal)?

2. How might this scenario affect safety and performance of the blades?
3. What steps can be taken to resolve the issue while prioritizing safety and efficiency?
4. How would you ensure proper documentation and tracking throughout the process?

4. **Group Presentations (20 minutes):** Each group will present their scenario analysis, solutions, and proposed actions to the rest of the class. Encourage other groups to ask questions and engage in discussion.
5. **Debriefing and Key Takeaways (20 minutes):** Lead a class discussion to review the activity outcomes. Focus on:
   1. How different groups approached the scenarios.
   2. How safety and performance considerations influenced their decisions.
   3. Key takeaways about effective dicing blade management and best practices for handling, storage, and disposal.

Scenario Cards (Examples):

- **Scenario 1:** A technician receives a batch of dicing blades but notices some of them are improperly stored and show signs of wear. The blades have also been exposed to high humidity during shipping. What steps should the technician take to ensure the blades' performance is not compromised? How should this situation be documented in the inventory system?
- **Scenario 2:** During routine checks, you notice that some dicing blades are being used beyond their optimal lifespan. Employees have also started to report irregular cutting performance, and safety concerns have been raised. What steps will you take to resolve this situation, and how will you ensure that blades are properly replaced and disposed of?
- **Scenario 3:** A storage room has recently been re-organized, and a few dicing blades are found without proper labeling or tracking. This is causing confusion regarding the stock levels and blade types. What actions should be taken to address this issue while ensuring that inventory management systems are updated and that employee safety is maintained during handling.

Activity	Duration	Resources used
Evaluating Food Service Preferences and Seasonal Menu Planning		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Ensure that groups prioritize safety protocols when handling the dicing blades and focus on how maintaining performance standards impacts both product quality and employee well-being.
- Prompt participants to think practically about how they can integrate best practices for inventory management into their daily workflow. Focus on real-world scenarios that impact both blade longevity and operational efficiency.
- Encourage each group to involve every team member in the discussion, fostering an interactive environment where all viewpoints are considered. This will lead to a more comprehensive solution to the scenarios.

Unit 2.5: Blade Wear Monitoring and Process Optimization

Unit Objectives

At the end of this unit, the participants will be able to:

1. Explain the importance of monitoring dicing blade wear for ensuring consistent performance and optimal throughput.
2. Discuss the relationship between blade wear and cutting efficiency, and how this impacts overall dicing quality.
3. Demonstrate how to adjust dicing parameters based on inspection findings to optimize the blade's lifespan and cutting performance.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the importance of monitoring dicing blade wear to ensure consistent performance and optimal throughput. We will explore the relationship between blade wear and cutting efficiency, focusing on how wear impacts overall dicing quality. Additionally, we will learn how to adjust dicing parameters based on inspection findings to optimize the lifespan and performance of the blades.

Ask

Ask the participants the following questions:

- How does monitoring the wear on dicing blades affect the overall efficiency and quality of the cutting process?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Importance of Monitoring Dicing Blade Wear

Monitoring dicing blade wear is crucial for ensuring that the blades maintain consistent cutting performance and optimal throughput. Regular inspection helps identify any early signs of wear, which can be addressed before they lead to performance degradation. This proactive approach helps maintain high-quality cuts, reduce downtime, and extend the lifespan of the blades, ultimately improving the efficiency of the overall production process

Relationship Between Blade Wear and Cutting Efficiency:

The relationship between blade wear and cutting efficiency is significant. As dicing blades wear down, their ability to make precise cuts diminishes, leading to reduced cutting efficiency. This can cause issues such as longer cycle times, poor chip quality, and more frequent tool changes. Dicing quality deteriorates when blades are not properly maintained, leading to material waste and higher costs in production.

Adjusting Dicing Parameters Based on Inspection Findings

Adjusting dicing parameters after inspecting blade wear is an essential practice to optimize both the blade's lifespan and cutting performance. By modifying parameters like speed, pressure, and feed rate according to the blade's condition, operators can enhance performance and prolong the blade's service life. These adjustments ensure that the cutting process remains effective, even as blades begin to wear down.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Exploring Dicing Blade Maintenance and Safety Procedures

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart,
- Markers,
- Scenario cards,
- Sticky notes (different colors)

Instructions:

Introduction (10 minutes):

Begin by reviewing the key concepts of dicing blade maintenance, including the importance of monitoring wear, adjusting parameters, and proper storage conditions. Explain the significance of these practices for ensuring consistent performance and maintaining safety. Briefly discuss best practices for dicing blade management, inventory, and disposal.

Distribute Scenario Cards (5 minutes):

Provide each group with a scenario card that describes a potential issue related to dicing blade management. Each scenario will present a challenge related to blade wear, performance, or safety protocols. The group will need to analyze the situation and come up with strategies to address the problem while ensuring safety and efficiency.

Group Discussion and Planning (20 minutes):

Groups will discuss their scenario using the following prompts:

1. What part of the dicing blade maintenance process does this scenario address (e.g., wear monitoring, storage, or disposal)?
2. How might this issue affect the overall production process and safety protocols?

3. What actions can be taken to resolve the issue while ensuring optimal blade performance and maintaining safety standards?
4. How can blade wear and safety considerations be communicated to the team to enhance awareness and engagement?

Group Presentations (20 minutes):

Each group will present their scenario, analysis, and proposed solutions to the rest of the class. Encourage the other groups to ask questions or offer feedback to generate discussion and further understanding of the topic.

Debriefing and Key Takeaways (5 minutes):

Facilitate a class discussion to summarize key points from each group. Focus on how effective blade management, monitoring, and safety procedures contribute to improved performance and safety in the workplace.

Scenario Cards (Examples):

- **Scenario 1:** During a routine inspection, a technician discovers that the dicing blade is showing early signs of glazing. The blade is still functional, but it has become less efficient. How would you address this issue to ensure that the blade continues to perform effectively while following safety protocols and maintaining productivity?
- **Scenario 2:** The inventory system shows a low quantity of dicing blades, but the next order won't arrive for a few days. How would you manage the inventory and prevent production delays? What steps would you take to ensure that the blades are stored properly and that team members are aware of the situation?
- **Scenario 3:** A worn-out dicing blade needs to be disposed of, but the disposal procedure isn't clear. What is the safest and most environmentally responsible method for disposing of the used blade? How would you ensure the team follows proper procedures?

Activity	Duration	Resources used
Exploring Dicing Blade Maintenance and Safety Procedures		Whiteboard or flipchart, Markers, Sticky notes (different colors), Menu design templates (optional) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Encourage participants to think beyond simple fixes and consider the long-term impact of their decisions on the production process, safety, and blade lifespan.
- Emphasize the importance of clear communication in a team setting, especially when it comes to addressing safety concerns and managing resources effectively.
- Throughout the activity, remind participants of best practices in blade management, such as regular inspections, safe handling, and proper inventory tracking to minimize issues in the production process.

Exercise

Multiple Choice Questions (MCQs)

1. What is the primary factor affecting blade selection when working with wafers of varying thickness?

   a) Blade length

   b) Blade material

   c) Wafer thickness

   d) Blade diameter

   Answer: c) Wafer thickness

2. Which of the following is NOT a sign of dicing blade wear?

   a) Chipped segments

   b) Reduced diameter

   c) Blade glazing

   d) Increased cutting speed

   Answer d) Increased cutting speed

3 .Why is it important to establish a routine inspection schedule for dicing blades?

   a) To reduce cutting costs

   b) To ensure blade performance and prevent damage

   c) To maintain inventory levels

   d) To extend the blade's storage time

   Answer: b) To ensure blade performance and prevent damage

4. Which inspection tool is typically used to examine the blade's wear level and detect chipping or cracks?

   a) Caliper

   b) Magnifying glass

   c) Torque wrench

   d) Laser scanner

   Answer: b) Magnifying glass

Fill in the Blanks

1. Proper storage conditions for dicing blades include controlling ________ levels and maintaining a ________ environment to ensure optimal blade performance.

   Answer: humidity, dust-free

2. The ________ helps track inventory levels, ensuring that enough dicing blades are available before stock runs out.

   Answer: inventory management software

3. To maintain accurate tracking of dicing blade condition, it is important to _______ the inspection findings, noting if the blade is usable or requires replacement.

   Answer: document

4. In dicing blade maintenance, the blade wear gauge is used to measure the _______ of the blade and assess any _______ that may impair its functionality.

   Answer: diameter, wear

1. Match the inspection tools with their purpose:

Inspection Tool	Purpose
a) Magnifying glass	1) To measure blade diameter
b) Blade wear gauge	2) To detect cracks and chips
c) Inventory management software	3) To track stock levels
d) Caliper	4) To check blade thickness

Answers: 1.-a) , 2.-b) , 3. -c) , 4.-d)

2. Match the blade maintenance actions with their purpose:

Action	Purpose
a) Routine inspection schedule	1) To ensure safe disposal of used blades
b) Documenting inspection findings	2) To track blade condition over time
c) Blade procurement process	3) To ensure consistent blade performance
d) Safe disposal of worn-out blades	4) To ensure adequate stock before depletion

Answers: a) - 3), b) - 2), c) - 4), d) - 1)

3. Dicing Yield Analysis & Optimization

Unit 3.1: Dicing Process and Yield Analysis
Unit 3.2: Process Data Interpretation and Defect Identification
Unit 3.3: Collaboration and Communication for Yield Improvement
Unit 3.4: Yield Improvement Strategies and Implementation
Unit 3.5: Post-Implementation Assessment and Documentation

TEL/N7214

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Explain how dicing process steps (e.g., sawing, cleaning) can impact wafer yield.
2. Explain how to interpret process data and equipment logs to identify potential causes of yield issues.
3. Identify common dicing defects (chipping, cracking, surface contamination) based on descriptions and visuals.
4. Explain the correlation between different defect types and potential causes in the dicing process.
5. Discuss the importance of clear communication and collaboration with different teams (process engineers, quality control) to share data and expertise.
6. Explain how to participate in brainstorming sessions to develop solutions for yield improvement.
7. Describe various strategies for improving dicing yield, such as adjusting process parameters, modifying equipment settings, and implementing new cleaning procedures.
8. Explain how to interpret post- implementation yield data to assess the effectiveness of corrective actions.
9. Explain the importance of documenting and sharing improvement results with relevant teams to facilitate ongoing yield optimization.
10. Demonstrate gathering diced wafer yield data from various simulated sources (e.g., sample reports).
11. Analyze sample data sets to understand the frequency and distribution of defect types.
12. Compare yield data with simulated process parameters and equipment logs to identify potential correlations.
13. Prioritize yield issues based on their severity and impact on overall yield using simulated scenarios.
14. Role-play initiating discussions with simulated cross-functional teams (process engineers, quality control) to share yield data and defect analysis.
15. Participate in group discussions and activities to brainstorm and propose potential solutions for identified yield issues.
16. Evaluate proposed solutions considering factors like feasibility, cost-effectiveness, and potential impact on other process parameters.
17. Develop a documented action plan for yield improvement based on classroom discussions and activities.
18. Define clear tasks and responsibilities for implementing the chosen strategies.

Unit 3.1: Dicing Process and Yield Analysis

Unit Objectives

At the end of this unit, the participants will be able to:

1. Explain how dicing process steps (e.g., sawing, cleaning) can impact wafer yield.
2. Identify common dicing defects (chipping, cracking, surface contamination) based on descriptions and visuals.
3. Explain the correlation between different defect types and potential causes in the dicing process.
4. Analyze sample data sets to understand the frequency and distribution of defect types.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the critical steps in the dicing process, including sawing and cleaning, and how they impact wafer yield. We will explore common dicing defects, their causes, and how to identify them. Additionally, we will analyze data on defect frequency and distribution to understand their correlation with process parameters and improve overall yield and quality.

Ask

Ask the participants the following questions:

- What are some common defects that can occur during the dicing process, and how do they affect wafer yield?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Dicing Process Steps Impacting Wafer Yield:

The dicing process is a multi-step procedure that directly impacts wafer yield. Here are the key steps in the dicing process and their effects:

- **Sawing:** This is the primary step where a dicing blade cuts the wafer into individual dies. The precision of sawing is crucial as incorrect blade speed, pressure, or alignment can result in defects like chipping or cracking along the edges, which reduces the number of usable dies and overall wafer yield.
- **Cleaning After Sawing:** Once the wafer is diced, cleaning is essential to remove any debris or residue left behind from the sawing process. Improper cleaning can cause contamination,

leaving particles or films on the wafer surface This contamination can lead to defects in the finished product, such as surface marks or poor adhesion, further reducing the yield.

Inspection: Following the sawing and cleaning processes, inspection ensures that no defects are present, and the dies are within quality standards. It helps detect early signs of issues such as misalignment, contamination, or chip damage that could compromise wafer yield.

Handling and Storage: After sawing and cleaning, the wafers must be handled with care to prevent any damage. Poor handling or improper storage conditions can lead to physical defects, compromising the final product yield.

Each of these steps must be carefully optimized to minimize defects and maintain the highest wafer yield.

Common Dicing Defects:

Common dicing defects include chipping, which occurs at the edges of the wafer due to improper sawing speed or blade wear; cracking, which can happen from excessive blade pressure or incorrect dicing parameters; and surface contamination, often resulting from inadequate cleaning after sawing. Identifying these defects visually through inspection tools helps prevent further issues and improves quality control.

Correlation Between Defect Types and Causes:

Defects such as chipping are often caused by improper cutting speed or worn-out blades, leading to uneven stress on the wafer. Cracking typically results from high dicing pressures or incorrect sawing techniques. Surface contamination is primarily caused by residues left from the sawing process if cleaning is not thorough. Recognizing the correlation between defects and their causes helps in adjusting the process to reduce defects and improve the overall quality.

Analyzing Sample Data Sets:

By analyzing data on defects, such as frequency and distribution, patterns can be identified that correlate with certain dicing parameters or process changes. This data-driven approach helps in pinpointing the root causes of defects, allowing for targeted adjustments in the process to reduce defect occurrence, enhance efficiency, and improve overall yield.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Dicing Process and Defect Analysis

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards (described below)

Instructions:

Introduction (5 minutes): Divide participants into groups of 4-6. Briefly explain the importance of the dicing process in wafer production and its potential impact on wafer yield and quality. Review the common dicing defects (chipping, cracking, surface contamination) and how these can be influenced by various stages of the dicing process.

Scenario Card Distribution (5 minutes): Provide each group with a scenario card. The card will describe a hypothetical situation involving a dicing defect or issue that could arise during the production process. Each group must analyze the scenario and consider how defects can affect wafer yield and quality.

Group Discussion and Planning (20 minutes): Each group will discuss the scenario and respond to the following prompts:

- What step in the dicing process is impacted by this defect (e.g., sawing, cleaning)?
- How might this defect influence wafer yield and overall production?
- What specific measures can be taken to reduce or eliminate this defect?
- What inspection tools or methods could be used to identify and resolve the issue?
- What impact might this defect have on final product quality?

Group Presentations (20 minutes): Each group will present their analysis, proposed solutions, and reasoning to the rest of the class. Encourage participants to ask questions and engage in a discussion about each group's proposed solutions.

Debriefing and Key Takeaways (10 minutes): After all groups have presented, facilitate a class-wide discussion. Focus on the key points, such as the impact of different defects on wafer yield, the importance of timely defect detection, and the relationship between dicing process steps and final product quality.

Scenario Cards (Examples):

- **Scenario 1**: A batch of wafers shows visible chipping along the edges after the sawing process. You suspect the dicing blade may be worn out. How would you investigate the issue, and what actions would you take to prevent this in future batches?
- **Scenario 2:** During routine quality checks, you observe cracking in the wafers that were cut under high pressure. What could be the cause of these cracks, and how would you adjust the sawing parameters to avoid this defect in the future?
- **Scenario 3**: After sawing a batch of wafers, there is noticeable surface contamination that affects the electrical performance of the chips. What do you think caused this contamination, and how would you address the issue to ensure clean and defect-free wafers?

Activity	Duration	Resources used
Group Activity: Dicing Process and Defect Analysis		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Ask participants to consider all stages of the dicing process when analyzing defects and consider how one step can affect the next. Promote detailed discussion around defect causes and resolutions.
- Emphasize the role of inspection tools, like magnifying glasses and blade wear gauges, in detecting defects early in the production process to minimize waste and improve yield.
- Remind participants of the critical importance of maintaining optimal cutting parameters, inspection routines, and maintenance schedules to ensure high-quality results in wafer production.

Unit 3.2: Process Data Interpretation and Defect Identification

Unit Objectives

At the end of this unit, the participants will be able to:

1. Explain how to interpret process data and equipment logs to identify potential causes of yield issues.
2. Compare yield data with simulated process parameters and equipment logs to identify potential correlations.
3. Prioritize yield issues based on their severity and impact on overall yield using simulated scenarios.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss how to interpret process data and equipment logs to identify yield issues, compare yield data with simulated process parameters, and prioritize yield issues based on their severity and impact on overall production. We will also explore methods for correlating process data to equipment performance and analyzing the most effective corrective actions.

Ask

Ask the participants the following questions:

- How can process data and equipment logs help identify the causes of yield issues in a production environment?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Interpreting Process Data and Equipment Logs to Identify Yield Issues:

Interpreting process data and equipment logs involves analyzing historical records of production processes and equipment performance to detect irregularities that may be causing yield issues. These logs typically contain information on operating conditions, cycle times, and machine performance. By reviewing these data points, operators can identify abnormal trends, such as equipment malfunction, process deviations, or improper settings, which could contribute to reduced yield. Understanding these data sets helps pinpoint the root causes of yield loss and allows for corrective actions to be taken.

Comparing Yield Data with Simulated Process Parameters and Equipment Logs:

By comparing yield data with simulated process parameters and equipment logs, operators can find correlations that indicate underlying problems. Simulated data allows for predictions based on ideal conditions, while real process data and equipment logs provide insights into actual performance. Identifying discrepancies between the two helps in detecting issues like machine wear, incorrect parameters, or process inefficiencies. Correlating yield data with these logs helps in fine-tuning the process and equipment settings to improve overall yield and efficiency.

Prioritizing Yield Issues Based on Severity and Impact:

To effectively address yield issues, it is important to prioritize them based on their severity and impact on overall production. Yield issues that cause significant product loss, such as those leading to defective wafers or lower-quality chips, should be addressed first. Using simulated scenarios, operators can assess how different issues might affect production yield, helping to prioritize actions that will have the most significant positive impact. This approach ensures that resources are focused on solving the most critical problems first, minimizing losses and improving process efficiency.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Simulating Yield Improvement in a Semiconductor Manufacturing Process with a Focus on Data Analysis and Process Optimization

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards (described below)
- Access to sample process data and equipment logs (fictional data for scenario)

Instructions:

Introduction to Activity:

Start by explaining the key concepts involved in semiconductor manufacturing, such as the process steps (dicing, sawing, cleaning), equipment performance, and yield monitoring. Briefly review the importance of process data and equipment logs in identifying and addressing yield issues.

Distribute Scenario Cards:

Provide each group with a scenario card. Each card will describe a hypothetical situation based on process data or equipment logs that may impact yield. The card will ask the group to analyze the data and propose solutions to improve yield.

Group Discussion and Planning (20 minutes):

Each group should discuss their assigned scenario using the following prompts

- What is the potential issue causing yield loss?
- How does the data or equipment log suggest this issue?

- What actions can be taken to address the issue and improve yield?
- How would you prioritize yield issues based on their impact and severity?

Group Presentations (20 minutes):

Each group will present their scenario, analysis, and proposed solutions to the class. Encourage questions from other groups to spark discussions on potential improvements.

Debriefing and Key Takeaways (20 minutes):

Facilitate a class-wide discussion to debrief the activity. Key points to explore include:

- How did each group analyze the data and logs?
- What differences in approaches were observed when addressing the yield issues?
- How did each group prioritize yield issues based on severity?
- What key insights were gained about optimizing the semiconductor manufacturing process?

Example of Scenario Cards :

- **Scenario 1:** During routine equipment maintenance, the process data indicates an increase in wafer defects. The logs show that the cutting speed has slightly deviated from the set parameters. How would you identify the cause of the defects and correct the issue to optimize yield?
- **Scenario 2:** After analyzing yield data, you notice a trend of increased chipping and surface contamination in recent batches. The equipment log shows that the cleaning system has been operating below its optimal efficiency. How would you address this issue to improve wafer quality and increase yield?
- **Scenario 3:** Yield data from the last few batches indicates inconsistent results, but there are no obvious changes in the process parameters. Upon reviewing equipment logs, you find fluctuations in equipment performance. How would you investigate the equipment issues to restore stable production and improve yield?

Activity	Duration	Resources used
Simulating Yield Improvement in a Semiconductor Manufacturing Process with a Focus on Data Analysis and Process Optimization		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below), Access to sample process data and equipment logs (fictional data for scenario)

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Explain the differences between markup and profit margin. While markup adds a fixed • Before starting, ensure that all participants understand basic semiconductor manufacturing terms and the role of data in process optimization.
- Encourage groups to collaborate on interpreting data and logs. Discussing multiple perspectives often leads to better problem-solving.
- Emphasize the importance of using real-time data and logs to make decisions and identify solutions. Make sure participants understand that these tools are essential for efficient problem-solving in manufacturing environments.

Unit 3.3: Collaboration and Communication for Yield Improvement

Unit Objectives

At the end of this unit, the participants will be able to:

1. Discuss the importance of clear communication and collaboration with different teams (process engineers, quality control) to share data and expertise.
2. Role-play initiating discussions with simulated cross-functional teams (process engineers, quality control) to share yield data and defect analysis.
3. Participate in group discussions and activities to brainstorm and propose potential solutions for identified yield issues

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

IIn this unit, we will discuss the importance of clear communication and collaboration between cross-functional teams, including process engineers and quality control. We will explore how sharing data and expertise can help resolve yield issues effectively. Through role-playing and group discussions, participants will learn how to initiate and participate in problem-solving conversations to improve manufacturing processes and yields.

Ask

Ask the participants the following questions:

- How does effective communication between process engineers and quality control teams help in solving yield issues?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Importance of Clear Communication and Collaboration with Different Teams:

Clear communication and collaboration with teams such as process engineers and quality control are crucial in resolving yield issues in semiconductor manufacturing. Sharing accurate data and insights between teams ensures that the right solutions are implemented quickly. Each team brings expertise to the table, such as process optimization knowledge from engineers or defect identification expertise from quality control. This collaboration is key to improving yield, reducing defects, and maintaining product quality.

Role-Playing Initiating Discussions with Cross-Functional Teams:

In this activity, participants can role-play scenarios where they initiate discussions with process engineers and quality control teams. By sharing yield data and defect analysis, participants practice effective communication and problem-solving skills. The goal is to collaboratively identify the root cause of issues and agree on action plans to improve yield. This exercise highlights the importance of team-based approaches in tackling production challenges.

Participating in Group Discussions to Brainstorm Solutions:

Group discussions help teams brainstorm potential solutions for yield issues by bringing together diverse perspectives. Sharing experiences and insights from different functional areas can lead to innovative solutions. These discussions foster a collaborative environment where all team members feel empowered to contribute ideas that can optimize the manufacturing process and improve overall yield.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Simulating a Yield Improvement Scenario in Semiconductor Manufacturing with a Focus on Collaboration and Problem Solving

Group Size: 4-6 participants

Materials

- Whiteboard or flipchart,
- Markers,
- Sticky notes (different colors),
- Scenario cards (described below)

Instructions:

1 .Divide participants into groups: Explain the activity objectives and the importance of collaboration between cross-functional teams (process engineers, quality control, etc.) in solving yield issues.

2 **.Brief review:** Provide a brief review of the semiconductor manufacturing process, the key aspects of yield analysis, and the roles of process engineers and quality control teams.

3 **.Distribute scenario cards:** Give each group a scenario card (one per group). Each card will describe a hypothetical situation that could arise in the manufacturing process, where yield issues need to be addressed through cross-functional collaboration.

4 **.Group Discussion and Planning (20 minutes):** Each group discusses their scenario using the following prompts:

1. What aspect of the semiconductor manufacturing process is impacted by this issue?
2. How could this issue affect yield and quality?
3. What data would you share with process engineers and quality control teams?

4. How would you collaborate with different teams to identify the root cause of the problem?
5. What steps would you take to resolve the issue while maintaining communication and collaboration across teams?

5. **Group Presentations (20 minutes):** Each group presents their scenario, analysis, and proposed solutions to the rest of the participants. Encourage questions and discussion from other groups.

6. **Debriefing and Key Takeaways (20 minutes):** Facilitate a class discussion to debrief the activity. Key points to consider:

1. What were the different approaches taken by each group to solve the issue?
2. How did collaboration between different teams influence the decisions made?
3. What are some key learnings from this activity regarding cross-functional communication and problem-solving?

Examples of Scenario Cards :

Scenario 1: During a routine yield analysis, a high percentage of wafers show defects such as surface contamination. The quality control team suspects the issue may stem from the cleaning process. How would you approach this issue, and how would you collaborate with process engineers to investigate the root cause and implement solutions?

Scenario 2: A recent change in the manufacturing process has resulted in a noticeable decline in yield. The process engineers believe the issue may be related to tool calibration, while quality control suspects it could be due to a contamination issue. How would you facilitate a discussion between the two teams to identify the cause and take corrective action?

Scenario 3: A significant yield drop has occurred during a critical phase of production. The process engineers believe the issue is related to temperature fluctuations during the etching process, while quality control suspects improper material handling. How would you communicate with both teams to gather data and analyze the situation for possible solutions?

Activity	Duration	Resources used
Simulating a Yield Improvement Scenario in Semiconductor Manufacturing with a Focus on Collaboration and Problem Solving		Whiteboard or flipchart, Markers,Sticky notes (different colors), Scenario cards (described below) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Ensure that participants feel comfortable sharing their ideas and data, fostering a collaborative atmosphere where all teams are heard.
- Encourage participants to think about how different aspects of the process (e.g., equipment calibration, material handling, or cleaning procedures) could contribute to yield issues.
- Remind participants of the importance of using process data, defect analysis, and logs to support decisions and guide problem-solving efforts across teams.

Unit 3.4: Yield Improvement Strategies and Implementation

Unit Objectives

At the end of this unit, the participants will be able to:

1. Describe various strategies for improving dicing yield, such as adjusting process parameters, modifying equipment settings, and implementing new cleaning procedures.
2. Evaluate proposed solutions considering factors like feasibility, cost-effectiveness, and potential impact on other process parameters.
3. Develop a documented action plan for yield improvement based on classroom discussions and activities.
4. Define clear tasks and responsibilities for implementing the chosen strategies.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss strategies for improving dicing yield through process adjustments, equipment optimization, and enhanced cleaning procedures. You will also learn how to evaluate the feasibility and cost-effectiveness of these solutions, develop an action plan, and assign tasks and responsibilities for successful implementation.

Ask

Ask the participants the following questions:

- How can adjusting process parameters and equipment settings improve dicing yield in semiconductor manufacturing?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Strategies for Improving Dicing Yield:

Improving dicing yield can be achieved through several strategies that focus on process optimization. One approach is adjusting process parameters, such as cutting speed, pressure, and blade rotation. Modifying equipment settings, including the blade feed rate and depth, can also enhance cutting precision. Implementing new cleaning procedures to remove contamination effectively before and after the dicing process is another critical strategy for reducing defects. These improvements help minimize wafer damage, optimize material usage, and increase the overall yield.

Evaluating Proposed Solutions:

When evaluating proposed solutions for improving yield, it is essential to consider several factors. Feasibility refers to whether the changes can be implemented without disrupting current workflows or requiring extensive modifications. Cost-effectiveness is another key consideration, as the proposed solutions should provide a measurable return on investment. Additionally, potential impacts on other process parameters, such as cycle time, equipment wear, and product quality, must be carefully assessed to ensure that improvements in yield do not introduce new issues.

Developing an Action Plan for Yield Improvement:

A documented action plan for yield improvement should outline the specific strategies to be implemented, the expected outcomes, and the timeline for execution. The plan should include a detailed analysis of the chosen solutions, including any necessary adjustments to equipment or processes. It is also important to establish clear milestones and metrics for tracking progress. The plan should be structured to ensure that the team can effectively implement improvements while addressing any unforeseen challenges.

Defining Tasks and Responsibilities:

Once an action plan is developed, it is crucial to define clear tasks and responsibilities for each team member. Assigning roles based on expertise and operational requirements ensures that each aspect of the yield improvement plan is handled efficiently. Responsibilities may include monitoring and adjusting equipment settings, overseeing the implementation of new cleaning procedures, or collecting data for ongoing analysis. Clear accountability fosters teamwork and ensures that everyone is aligned toward achieving the goal of improving dicing yield.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Identifying and Addressing Yield Issues in Dicing Process

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart,
- Markers,
- Sticky notes (different colors),
- Scenario cards (described below)

Instructions:

- Divide participants into groups. Explain the activity objectives and briefly review the dicing process, common yield issues, and defect causes.
- Distribute scenario cards (one per group). Each card will describe a hypothetical scenario related to yield issues in the dicing process. The scenario should present a challenge requiring the group to think about how to improve yield through adjustments in process parameters, equipment settings, and cleaning procedures.

- Each group will discuss the scenario, assess the potential causes of the yield issue, and propose solutions. They must also consider the feasibility, cost-effectiveness, and potential impact of their solutions.

Group Discussion and Planning (20 minutes):

Each group should discuss the scenario using the following prompts:

1. What stage of the dicing process is impacted by this issue?
2. What are the potential causes of the yield issue, and how can they be resolved?
3. What changes to process parameters, equipment settings, or cleaning procedures can help improve yield?
4. What are the feasibility, cost-effectiveness, and impact of the proposed solutions?

Group Presentations (20 minutes):

Each group will present their scenario, analysis, and proposed solutions to the rest of the class. Encourage questions and discussions from other groups.

Debriefing and Key Takeaways (20 minutes):

Facilitate a class discussion to debrief on the activity. Key points to consider:

1. How did each group approach the problem and propose solutions?
2. How did you prioritize different factors such as feasibility, cost, and impact?
3. What strategies were most effective for improving yield in the scenarios presented?

Example of Scenario Cards :

Scenario 1: During a routine inspection, a significant amount of wafer chipping is noticed during the dicing process. What changes can be made to process parameters or equipment settings to minimize chipping and improve yield?

Scenario 2: After cleaning the equipment, residual debris is found on the wafer surface, affecting the cut. How can cleaning procedures be adjusted to reduce contamination and improve yield?

Scenario 3: A decrease in dicing yield is observed without any clear explanation. After reviewing the data logs, you notice a slight variation in the cutting speed and pressure. How would you address this issue to ensure consistency and improve yield?

Activity	Duration	Resources used
Identifying and Addressing Yield Issues in Dicing Process		Whiteboard or flipchart, Markers, Sticky notes (different colors),Scenario cards (described below) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Encourage groups to take a systematic approach to problem-solving by focusing on root causes of yield issues.
- Emphasize the importance of collaboration within the group to evaluate solutions from multiple perspectives (technical, financial, and operational).
- Remind participants to consider all aspects of the dicing process, including equipment, parameters, and post-dicing cleaning, when proposing solutions.

Unit 3.5: Post-Implementation Assessment and Documentation

Unit Objectives

At the end of this unit, the participants will be able to:

1. Explain how to interpret post-implementation yield data to assess the effectiveness of corrective actions.
2. Explain the importance of documenting and sharing improvement results with relevant teams to facilitate ongoing yield optimization

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the methods of interpreting post-implementation yield data, evaluating the effectiveness of corrective actions, and the importance of documenting and sharing the results with relevant teams to facilitate ongoing yield improvement. You will learn how data analysis plays a key role in refining the production process.

Ask

Ask the participants the following questions:

- How can analyzing post-implementation yield data help us improve the manufacturing process?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Interpreting Post-Implementation Yield Data:

After implementing corrective actions to improve yield, it is crucial to analyze post-implementation data to determine the effectiveness of the changes. By comparing the yield before and after the adjustments, you can assess whether the modifications led to a reduction in defects, improved cutting precision, and optimized material usage. Additionally, monitoring any new patterns or anomalies in the data helps ensure the corrective actions are sustainable and continue to deliver improvements over time.

Documenting and Sharing Improvement Results:

- Documenting and sharing the results of yield improvement efforts are essential for fostering collaboration and continuous improvement within teams. Clear documentation allows teams to track the success of implemented strategies and analyze what worked well or needs further adjustment. Sharing the results with relevant teams such as process engineers, quality control, and equipment maintenance ensures that the learnings are disseminated, and similar strategies can be applied to other areas for sustained yield optimization across the production process.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Yield Optimization in the Dicing Process

Group Size: 4-6 participants

Materials

- Whiteboard or flipchart,
- markers,
- sticky notes (different colors),
- scenario cards (described below)

Instructions:

- Divide partiWcipants into groups and explain the activity objectives.
- Briefly review the dicing process, the importance of yield optimization, and the factors affecting yield, such as equipment settings, process parameters, and cleaning procedures.
- Distribute scenario cards (one per group). Each card will describe a hypothetical situation affecting yield optimization in the dicing process. The scenario should require the group to consider adjusting parameters, modifying equipment settings, and implementing corrective actions.

Group Discussion and Planning (20 minutes):

- Each group will discuss the scenario using the following prompts:
  - What process steps are impacted by the scenario?
  - How can the dicing yield be improved by adjusting process parameters or equipment settings?
  - What potential challenges could arise in implementing the proposed solutions?
  - What safety or operational considerations need to be taken into account?
  - As a team, propose an action plan for optimizing yield, including specific tasks and responsibilities.

Group Presentations (20 minutes):

- Each group will present their scenario, analysis, and proposed solutions to the rest of the class. Encourage questions and discussions from other groups

Debriefing and Key Takeaways (20 minutes):

- Facilitate a class discussion to debrief on the activity. Key points to consider:
  - What were the different approaches taken by each group to address the yield issue?
  - How did the proposed solutions impact other process parameters?
  - What are the key learnings regarding yield optimization, equipment settings, and corrective actions?

Examples of Scenario Cards

- **Scenario 1**: The dicing yield has dropped significantly due to increased defects in the wafer. After reviewing the equipment logs, the team suspects that the blade feed rate and cutting speed need adjustment. How would you propose to optimize these settings while maintaining process stability and minimizing further defects?
- **Scenario 2**: After implementing a new cleaning procedure, the dicing yield improved but there are still occasional defects due to contamination. How would you identify the source of the contamination and propose further improvements to enhance yield?
- **Scenario 3:** The cutting precision of the blade has decreased, resulting in more wafer breakage. How would you modify the equipment settings or process parameters to improve cutting precision and overall yield?

Activity	Duration	Resources used
Yield Optimization in the Dicing Process		Whiteboard or flipchart, markers, sticky notes (different colors), scenario cards (described below) etc.)

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Ensure that participants collaborate and share ideas on how to improve the yield, ensuring all team members contribute to the discussion.
- Emphasize the importance of considering the feasibility of the proposed solutions in terms of cost, resources, and time.
- Encourage participants to refer to theoretical knowledge and apply it practically in their solutions, making connections between equipment settings, process parameters, and real-world outcomes.

Exercise

Multiple Choice Questions (MCQs)

1. Which of the following process steps can significantly impact wafer yield during dicing?
   a) Packaging
   b) Sawing
   c) Cleaning
   d) Both b and c
   Answer: d) Both b and c

2. What is a common cause of chipping defects in the dicing process?
   a) Low cutting speed
   b) High cutting speed
   c) Excessive cleaning pressure
   d) Improper wafer mounting
   Answer: b) High cutting speed

3. When interpreting process data to identify potential causes of yield issues, which of the following would be most helpful?
   a) Process parameter logs
   b) Final product reviews
   c) Customer feedback
   d) Equipment aesthetics
   Answer: a) Process parameter logs

4. Why is it important to document and share yield improvement results with relevant teams?
   a) To increase production speed
   b) To enhance team collaboration and facilitate ongoing yield optimization
   c) To reduce worker morale
   d) To track employee performance
   Answer: b) To enhance team collaboration and facilitate ongoing yield optimization

Fill in the Blanks

1 The dicing process involves cutting a wafer into individual chips, which is typically done using a _____________ process.

Answer: sawing

2 One common defect during the dicing process is _____________, which occurs when the wafer edges are broken or damaged during cutting.

Answer: chipping

3. In order to interpret post-implementation yield data, one must analyze the changes in process parameters and correlate them with the ____________.

   Answer: defect types

4. Cross-functional collaboration between ____________ and ____________ is essential to identify and address yield-related issues effectively.

   Answer: process engineers, quality control

3. Match the Following:

Column A	Column B
1. Chipping	a) Reduces contamination and improves yield quality
2. Cleaning Procedure	b) Helps identify the root causes of yield issues
3. Process Parameter Logs	c) Affects wafer edges during cutting
4. Yield Data Sharing	d) Essential for continuous improvement and collaboration

Answers: 1.- c), 2.- a), 3. - b), 4. - d)

4. Match the Following:

Column A	Column B
1. Dicing Process Step (Sawing)	a) Leads to contamination and reduced yield
2. Common Dicing Defect (Cracking)	b) Involves cutting the wafer into individual chips
3. Defect Identification (Chipping)	c) Can be caused by excessive force or improper blade settings
4. Post-Implementation Yield Data	d) Helps assess the success of corrective actions after changes

Answers: 1. - b), 2.- c), 3.- a),4. d)

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4. Dicing Equipment Maintenance & Reporting

TEL/N7215

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Explain the importance and components of manufacturer's recommended maintenance schedules for dicing equipment.
2. Describe basic cleaning and lubrication procedures for dicing equipment components.
3. Explain the importance of calibration for maintaining consistent dicing performance.
4. Identify potential causes of unusual observations during maintenance, such as excessive wear, loose components, or strange noises. Explain the role of assisting qualified personnel with calibration procedures, including the purpose of recording data.
5. Explain how dicing process parameters (speed, force, blade type) affect results.
6. Describe methods for collecting and documenting yield data (good/defect counts).
7. Identify trends and potential issues in yield data through explanation.
8. Explain company procedures for recording data, generating reports, and storing records.
9. Describe safe operating procedures for dicing equipment (lockout/tagout, blade handling).
10. Explain regulations for handling hazardous materials used during dicing (coolants, cleaning solutions).
11. Explain how to identify potential safety hazards in the dicing workplace (electrical, slipping).
12. Explain the proper use and maintenance of personal protective equipment (PPE).
13. Demonstrate how to review manufacturer's recommended maintenance schedules and identify specific components requiring maintenance.
14. Perform basic cleaning tasks on a simulated or non-operational dicing equipment as per guidelines (e.g., dust removal, debris cleaning).
15. Perform replenishment or replacement of consumables according to a simulated schedule (e.g., lubricants, coolants).
16. Apply knowledge to differentiate between normal operation and potential issues based on audio or video recordings of dicing equipment.
17. Observe a qualified person performing calibration procedures and explain the purpose of specific steps.
18. Record simulated calibration data and report any discrepancies observed during the process.
19. Maintain records of simulated calibration activities, including the date, equipment components calibrated, and any relevant observations

Unit 4.1: Equipment Maintenance and Calibration

Unit Objectives

At the end of this unit, the participants will be able to:

1. Explain the importance and components of manufacturer's recommended maintenance schedules for dicing equipment.
2. Describe basic cleaning and lubrication procedures for dicing equipment components.
3. Explain the importance of calibration for maintaining consistent dicing performance.
4. Identify potential causes of unusual observations during maintenance, such as excessive wear, loose components, or strange noises.
5. Explain the role of assisting qualified personnel with calibration procedures, including the purpose of recording data.
6. Demonstrate how to review manufacturer's recommended maintenance schedules and identify specific components requiring maintenance.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the importance of following maintenance schedules for dicing equipment, including cleaning, lubrication, and calibration procedures. We will also cover how to identify unusual observations during maintenance and the role of assisting qualified personnel in maintaining consistent equipment performance.

Ask

Ask the participants the following questions:

- Why is regular maintenance and calibration important for the long-term performance of dicing equipment?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Importance and Components of Manufacturer's Recommended Maintenance Schedules for Dicing Equipment:

Manufacturer's recommended maintenance schedules are crucial to ensure the long-term performance and efficiency of dicing equipment. These schedules outline specific maintenance tasks that should be performed at regular intervals to prevent breakdowns, reduce downtime, and maintain high-quality wafer yields. The components typically covered include the cutting blades, motors, lubrication systems, and sensors. Adhering to these schedules ensures optimal functioning and helps identify potential issues before they lead to more significant problems.

Basic Cleaning and Lubrication Procedures for Dicing Equipment Components:

Basic cleaning and lubrication procedures are vital for maintaining dicing equipment in good working condition. Cleaning helps remove any debris, dust, or residue that may accumulate during operation, preventing it from interfering with the cutting process. Lubrication ensures smooth movement of parts like motors and cutting blades, minimizing wear and reducing friction. Regularly performing these procedures helps prevent damage and ensures consistency in dicing performance.

Importance of Calibration for Maintaining Consistent Dicing Performance:

Calibration is essential to ensure that the dicing equipment operates with precision. Regular calibration maintains the equipment's alignment, ensuring that the cutting process remains consistent and accurate. Without proper calibration, the dicing process could produce defective wafers, resulting in yield loss. Calibration helps maintain the integrity of the equipment's performance, reducing variations in wafer thickness and improving overall yield quality.

Potential Causes of Unusual Observations During Maintenance:

During maintenance, unusual observations such as excessive wear, loose components, or strange noises may indicate underlying issues. Excessive wear can be caused by improper handling, overuse, or poor lubrication, affecting the performance of critical parts like the blade or motor. Loose components may result from insufficient tightening or wear, potentially leading to misalignment or malfunction. Strange noises could be a sign of mechanical failure, requiring immediate attention to prevent further damage.

Role of Assisting Qualified Personnel with Calibration Procedures:

Assisting qualified personnel with calibration procedures involves supporting them by preparing the equipment, recording data, and ensuring that all settings are correct during the calibration process. Accurate data recording is essential for tracking performance over time and identifying any deviations from standard operating conditions. Proper assistance ensures that calibration is performed correctly and that the equipment continues to function efficiently, maintaining high precision in dicing operations.

Reviewing Manufacturer's Recommended Maintenance Schedules:

Reviewing manufacturer's recommended maintenance schedules involves regularly checking the equipment's maintenance log to identify specific components that require attention. The schedule will detail when each part, such as the blade, motors, and lubrication systems, should be cleaned, adjusted, or replaced. Reviewing the schedule ensures that the equipment is maintained in optimal condition and helps prevent unexpected failures by addressing potential issues proactively.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Improving Dicing Yield with a Focus on Process Optimization and Collaboration

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart,
- Markers,

- Sticky notes (different colors),
- Scenario cards

Instructions:

1. Divide participants into small groups and explain the objectives of the activity, which focus on improving dicing yield through process optimization and effective collaboration.
2. Briefly review key concepts such as dicing yield, common defects, and the importance of team collaboration in solving process-related issues.
3. Distribute scenario cards (one per group). Each scenario should describe a challenge in the dicing process that may affect yield, such as a defect, equipment malfunction, or process inefficiency.
4. Ask the groups to discuss the scenario and develop a plan to improve yield by considering the following prompts:
    1. What dicing process step is most impacted by this issue?
    2. How can process parameters, equipment settings, and cleaning procedures be adjusted to address the challenge?
    3. What role does communication and collaboration play in finding a solution?
5. After 20 minutes of group discussion and planning, have each group present their scenario, analysis, and proposed solutions to the class. Encourage other groups to ask questions and provide feedback.

Group Presentations (20 minutes):

- Each group will present their findings and solutions. After each presentation, allow time for questions and suggestions from the other groups.

Debriefing and Key Takeaways (20 minutes):

- Facilitate a class discussion to review the solutions presented by each group. Focus on the following key points:
    - How did each group approach the scenario to address yield improvement?
    - What strategies were suggested to optimize the dicing process?
    - How important is collaboration between teams, such as process engineers and quality control, in identifying and resolving issues?
    - What are the key lessons learned about improving yield and maintaining efficient dicing operations?

Examples of Scenario Cards :

- **Scenario 1**: A group of diced wafers is showing excessive chipping and cracking. The wafers were cut at a high speed with minimal cleaning prior to dicing. How would you address this issue to reduce defects and improve the yield?
- **Scenario 2**: The equipment is generating unusual noise during the dicing process, and yield has dropped significantly in the last few hours. What could be the possible causes, and how would you collaborate with maintenance and process engineers to resolve the problem?
- **Scenario 3:** A new cleaning procedure has been implemented, but after its introduction, you notice an increase in surface contamination on diced wafers. How would you troubleshoot the issue and ensure that the cleaning process is optimized for better yield?

Activity	Duration	Resources used
Improving Dicing Yield with a Focus on Process Optimization and Collaboration		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Encourage participants to think critically about both the technical and collaborative aspects of the scenario, focusing on how adjustments in equipment and process parameters can help improve yield.
- Remind groups to consider the role of communication with other teams (e.g., process engineers and quality control) when addressing complex issues. Collaboration and data sharing can help identify root causes and optimize solutions.
- Foster a constructive environment during group presentations by encouraging participants to ask thoughtful questions and suggest improvements to each group's approach.

Unit 4.2: Dicing Process Parameters and Data Documentation

Unit Objectives

At the end of this unit, the participants will be able to:

1. Explain how dicing process parameters (speed, force, blade type) affect results.
2. Describe methods for collecting and documenting yield data (good/defect counts).
3. Identify trends and potential issues in yield data through explanation.
4. Explain company procedures for recording data, generating reports, and storing records.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the critical dicing process parameters such as speed, force, and blade type, and how they influence the quality and yield of diced wafers. We will also explore methods for collecting and documenting yield data, identifying trends, and recognizing potential issues. Additionally, the unit will cover company procedures for recording data, generating reports, and storing records to ensure proper tracking and management of yield information.

Ask

Ask the participants the following questions:

- How do changes in dicing parameters like speed, force, or blade type affect wafer yield?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Dicing Process Parameters (Speed, Force, Blade Type):

The speed, force, and blade type during dicing directly affect the quality of the cut and the resulting wafer yield. Higher speed may increase throughput but could lead to more defects like chipping or cracking. The force applied during the dicing process needs to be balanced to avoid excessive stress on the wafer. The choice of blade type (diamond, steel, etc.) influences the precision and smoothness of the cut, impacting yield and product quality.

Methods for Collecting and Documenting Yield Data:

Yield data should be systematically collected during the dicing process, including good counts (defect-free wafers) and defect counts (e.g., cracks, chips, contamination). It is important to use automated tools or manual logs to track each wafer's status. This data should be recorded regularly and consistently to ensure accuracy and enable trend analysis over time.

Identifying Trends and Potential Issues in Yield Data:

By reviewing yield data, patterns can emerge that indicate areas for improvement in the process. For example, a consistent increase in defects after a specific production run may point to issues with equipment calibration, process parameters, or material quality. Identifying these trends early allows for corrective actions to be taken before yield drops significantly.

Company Procedures for Recording Data, Generating Reports, and Storing Records:

Companies usually have specific procedures for data recording, such as using digital systems for tracking and inputting yield data. Regular reports are generated to analyze yield trends and highlight problem areas. These records must be stored securely and organized for easy access, as they provide essential data for process improvements and regulatory compliance.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Identifying and Solving Dicing Yield Issues

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Scenario cards (described below)
- Diced wafer sample reports (optional)

Instructions:

Divide participants into groups: Explain that they will be working in groups to simulate a scenario in the dicing process, where they will be responsible for analyzing yield data, identifying issues, and proposing solutions.

Briefly review the dicing process: Explain key elements of the dicing process, including parameters like speed, force, and blade type. Emphasize the importance of monitoring yield data (good/defect counts) and how the choice of equipment and settings affects the overall yield.

Distribute scenario cards: Each group will receive a scenario card outlining a situation where there is a problem with dicing yield. These scenarios will involve potential defects, equipment issues, or process-related challenges.

Group Discussion and Planning (20 minutes):

Each group will discuss the scenario using the following prompts:

1. What dicing process parameters (e.g., speed, force, blade type) may be causing the issue?
2. How can the group interpret the yield data and identify the root cause?
3. What actions or process adjustments should be taken to address the issue and improve yield?
4. How would they communicate their proposed solutions to other teams (e.g., process engineers, quality control)?

Group Presentations (20 minutes):

Each group will present their scenario, analysis, and proposed solutions to the class. Encourage questions and discussions from other groups to explore different approaches to resolving yield issues

Debriefing and Key Takeaways (20 minutes):

Facilitate a class discussion to reflect on the activity. Key points to consider:

1. What were the most common causes of yield issues identified by the groups?
2. How did they interpret data and use it to diagnose problems?
3. What role did communication play in proposing solutions?
4. What are some key takeaways for improving dicing yield in a real-world setting?

Examples of Scenario Cards

- **Scenario 1**: During routine dicing, a consistent pattern of chipping is observed on the edges of diced wafers. The defect seems to be happening after a specific batch. What process parameters (e.g., speed, force, blade type) could be adjusted to reduce the chipping? How would you investigate if the problem is due to equipment or process settings?
- **Scenario 2**: Yield data from the last few runs shows an increase in contamination marks on the wafer surface. The cleaning procedure has not changed, but there may be an issue with how the dicing blades are handled. How would you collect additional data to understand the root cause? What cleaning and maintenance procedures should be reviewed?
- **Scenario 3**: There is a significant decline in yield for a specific wafer material, with many wafers showing cracks after dicing. How might the material itself be impacting the dicing process? What adjustments to force or blade type could help improve yield? How can you communicate the findings to the engineering team?

Activity	Duration	Resources used
Identifying and Solving Dicing Yield Issues		Whiteboard or flipchart, Markers, Scenario cards (described below), Diced wafer sample reports (optional) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- As groups discuss the scenarios, prompt them to think critically about process parameters and equipment maintenance. Push them to consider how different factors, like material quality, blade sharpness, or cutting speed, can affect the overall yield.
- Emphasize the importance of interpreting yield data and identifying trends over time. Ask participants to think about how they can use data to pinpoint potential issues, and how to adjust settings or procedures based on this information.
- Stress the importance of clear and concise communication when proposing solutions. Encourage participants to think about how they would share their findings and recommendations with other teams to ensure improvements are made collaboratively

Unit 4.3: Safety Protocols and Hazard Management

Unit Objectives

At the end of this unit, the participants will be able to:

1. Describe safe operating procedures for dicing equipment (lockout/tagout, blade handling).
2. Explain regulations for handling hazardous materials used during dicing (coolants, cleaning solutions).
3. Explain how to identify potential safety hazards in the dicing workplace (electrical, slipping).
4. Explain the proper use and maintenance of personal protective equipment (PPE).

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the critical safety protocols involved in operating dicing equipment, including the proper handling of materials, personal protective equipment (PPE), and identifying hazards in the workplace. You will learn about safe operating procedures, handling hazardous substances, and how to maintain a safe working environment to ensure that all workers are protected from potential dangers.

Ask

Ask the participants the following questions:

- What are the key safety precautions you must take when operating dicing equipment?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Safe Operating Procedures for Dicing Equipment:

Safe operating procedures are essential for minimizing accidents and injuries while using dicing equipment. Lockout/tagout (LOTO) procedures must be followed to ensure the equipment is properly powered down during maintenance or repairs. This involves disconnecting power sources and securing equipment with tags to prevent accidental reactivation. Additionally, proper blade handling techniques must be adhered to, including wearing gloves and using specialized tools to handle sharp or hot blades to prevent cuts and burns.

Regulations for Handling Hazardous Materials Used During Dicing:

Dicing often involves the use of hazardous materials such as coolants and cleaning solutions. These chemicals can pose health risks if not handled correctly. Regulations require proper storage, labeling, and disposal methods for these substances. Workers should be trained in using material safety data sheets (MSDS) to understand the properties and safety precautions for each chemical. Adequate ventilation, proper containment, and spill response plans must be in place to minimize exposure.

Identifying Potential Safety Hazards in the Dicing Workplace:

The dicing workplace can pose various safety hazards, including electrical risks, tripping hazards, and exposure to flying debris or chemicals. Electrical hazards can occur if equipment is not properly grounded or if power sources are exposed. Slips, trips, and falls are common if spills or clutter are present. It's important to maintain clean, organized workspaces and conduct regular inspections to identify and address hazards proactively. Workers should be trained to recognize potential risks and report them immediately.

Proper Use and Maintenance of Personal Protective Equipment (PPE):

Personal protective equipment (PPE) is crucial for worker safety during dicing operations. This includes gloves, safety goggles, hearing protection, and lab coats. Workers should ensure that PPE is properly fitted and maintained to ensure maximum protection. Regular inspections of PPE should be conducted to check for damage or wear. Training on proper usage, including when and how to wear PPE, helps prevent injuries related to exposure to chemicals, sharp objects, and noise.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Addressing Safety Hazards and Employee Engagement in Dicing Equipment Operations

Group Size: 4-6 participants

Materials

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards (described below)

Instructions:

1. **Divide participants into groups:** Explain the objective of the activity, which is to address potential safety hazards in the dicing equipment operations while also considering employee engagement.
2. **Brief Review**: Provide a brief review of the dicing process, the importance of employee safety, and engagement in the workplace.

3. **Distribute Scenario Cards:** Give each group a scenario card. Each card will describe a situation in a dicing equipment operation that requires addressing safety hazards while keeping employee morale and engagement in focus.
4. **Group Discussion and Planning (20 minutes):** Ask each group to discuss their scenario and use the following prompts:
    1. What stage of the dicing operation is impacted by the safety hazard in this scenario?
    2. How might this hazard affect employee morale and engagement?
    3. What safety protocols should be considered when addressing this scenario?
    4. Propose solutions to address the safety hazard while keeping employees engaged and ensuring safety.
5. **Group Presentations (20 minutes):** Have each group present their scenario, the analysis, and proposed solutions to the class. Encourage questions and discussions from other groups.
6. **Debriefing and Key Takeaways (20 minutes):** Facilitate a discussion to debrief on the activity. Discuss how safety hazards were addressed, and how employee engagement played a role in the decision-making process. Key points to consider:
    1. What were the approaches taken by each group to address the safety hazards?
    2. How did employee engagement and safety considerations influence the proposed solutions?
    3. What are some key learnings from this activity regarding the safe operation of dicing equipment and maintaining employee engagement?

- **Examples of Scenario Cards :**
- **Scenario 1:** During a regular maintenance check, a technician notices an electrical wiring issue in the dicing equipment that poses a risk of short-circuiting. The issue needs immediate attention but might cause production delays. How would you address this with your team, ensuring their safety while maintaining productivity and morale?
- **Scenario 2:** A worker reports experiencing eye discomfort after working with dicing equipment that uses high-speed blades. There may be an issue with the ventilation or safety glasses not fitting properly. How do you address the worker's concern while maintaining safety protocols and promoting employee engagement?
- **Scenario 3**: There has been an increase in slips and falls near the dicing area due to coolant spillage. How would you address the safety hazard and keep the team informed and engaged about the importance of workplace cleanliness and following safety protocols?

Activity	Duration	Resources used
Addressing Safety Hazards and Employee Engagement in Dicing Equipment Operations		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Stress the importance of teamwork in solving real-life problems. Ensure each participant contributes their thoughts and insights during the group discussion.
- Remind participants that addressing safety hazards is not only about protecting workers physically but also keeping them engaged by listening to their concerns and involving them in solutions.
- Ensure that the safety measures discussed are aligned with best practices and company guidelines. Encourage participants to think critically about safety but also how their solutions can affect morale and productivity.

Unit 4.4: Cleaning, Lubrication, and Consumables Maintenance

Unit Objectives

At the end of this unit, the participants will be able to:

1. Perform basic cleaning tasks on simulated or non-operational dicing equipment as per guidelines (e.g., dust removal, debris cleaning).
2. Perform replenishment or replacement of consumables according to a simulated schedule (e.g., lubricants, coolants).
3. Apply knowledge to differentiate between normal operation and potential issues based on audio or video recordings of dicing equipment.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the essential procedures for maintaining dicing equipment, including performing cleaning tasks, replacing consumables, and identifying potential operational issues through audio or video recordings. These skills are important for ensuring the smooth operation and longevity of dicing machinery while preventing defects and safety hazards in the process.

Ask

Ask the participants the following questions:

- What are the key steps involved in maintaining dicing equipment, and why is it important to identify issues early through audio or video observations?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Performing Basic Cleaning Tasks on Simulated or Non-Operational Dicing Equipment

Cleaning dicing equipment is essential for maintaining its operational efficiency and preventing defects. Tasks include removing dust, debris, and residues from the equipment to avoid contamination during the dicing process. Following the manufacturer's cleaning guidelines ensures that the equipment remains in good condition and minimizes potential malfunctions. Cleaning tasks are typically performed when the equipment is non-operational to ensure safety and avoid disruptions.

Performing Replenishment or Replacement of Consumables According to a Simulated Schedule

Consumables like lubricants and coolants play a crucial role in the dicing process by reducing friction, cooling the blades, and preventing overheating. Regular replenishment or replacement of these consumables is essential to maintaining the machine's performance and prolonging its life. A simulated schedule for consumables ensures that the equipment operates smoothly without disruptions due to low or degraded materials. This process is vital for maintaining the consistency and quality of dicing operations.

Differentiating Between Normal Operation and Potential Issues Using Audio or Video Recordings

Equipment often produces sounds or visual cues that can indicate normal operation or potential issues. Listening for typical operating sounds such as consistent hums or the smooth cutting motion of the blades helps operators identify when something is out of the ordinary. Video recordings of dicing operations can highlight irregularities like unusual blade movements, overheating, or vibrations. Differentiating between normal and abnormal signs helps in early detection and prevents serious damage to the equipment

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Addressing Safety and Maintenance Challenges in Dicing Operations

Group Size: 4-6 participants

Materials:

- Whiteboard or flipchart
- Markers
- Sticky notes (different colors)
- Scenario cards (described below)

Instructions:

1. **Introduction:** Divide participants into small groups of 4-6. Briefly review the key concepts of safe operating procedures for dicing equipment, regulations for handling hazardous materials, and the importance of identifying safety hazards in the workplace.
2. **Distribute Scenario Cards:** Each group will receive a scenario card describing a potential situation related to dicing operations, such as equipment malfunction, hazardous material handling, or safety hazards in the workplace.
3. **Group Discussion and Planning (20 minutes):** Groups will discuss the scenario and use the following prompts to guide their discussion:
    1. What specific safety protocols need to be followed in this situation?
    2. How would you communicate and involve the team to ensure safety during the process?
    3. What preventative actions can be implemented to address the issue and minimize risk?
    4. How can the maintenance of equipment be balanced with keeping employees engaged and ensuring safety?
4. **Group Presentations (20 minutes):** Each group will present their scenario, analysis, and proposed solution to the class. Encourage other groups to ask questions or offer suggestions for improving the approach.

1. How did each group approach the safety challenge?
2. How were employee engagement and safety protocols incorporated into the solution?
3. What are the main takeaways regarding the role of safety and maintenance in dicing operations?

5. **Debriefing and Key Takeaways (20 minutes):** Facilitate a class discussion to debrief on the activity, discussing:

Scenario Cards (Examples):

Scenario 1: During a routine maintenance check, a technician discovers a minor leak in the cutting fluid reservoir of a dicing machine. While the leak does not pose an immediate safety hazard, it could result in decreased performance over time. How would you handle this situation while ensuring safety and maintaining employee engagement?

Scenario 2: The team is working in a high-stress environment with a significant workload, and there have been complaints about fatigue and safety concerns due to prolonged exposure to cutting equipment. How would you address these concerns and improve employee morale while adhering to safety protocols?

Scenario 3: While performing routine maintenance on a dicing machine, an operator notices that the blade is becoming dull and is causing a reduction in the quality of the cuts. How would you manage this issue to ensure equipment safety and maintain production efficiency while ensuring the team is aware of the safety concerns and involved in the decision-making process?

Activity	Duration	Resources used
Addressing Safety and Maintenance Challenges in Dicing Operations		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Make sure that each group member participates in the discussion and that the group works collaboratively to address the scenario. This can help in understanding different perspectives on safety and employee engagement.
- Ensure that participants focus on integrating established safety protocols into their proposed solutions. Reinforce the importance of following lockout/tagout procedures, PPE usage, and handling hazardous materials appropriately.
- Help participants connect theoretical knowledge about safety and maintenance procedures with real-life situations, emphasizing the importance of early identification of problems and the role of communication in maintaining a safe work environment.

Unit 4.5: Calibration Procedures and Record Keeping

Unit Objectives

At the end of this unit, the participants will be able to:

1. Observe a qualified person performing calibration procedures and explain the purpose of specific steps.
2. Record simulated calibration data and report any discrepancies observed during the process.
3. Maintain records of simulated calibration activities, including the date, equipment components calibrated, and any relevant observations.

Resources to be Used

Participant handbook, pen, notebook, whiteboard, flipchart, markers, laptop, overhead projector, laser pointer, etc.

Note

In this unit, we will discuss the importance of proper calibration procedures for equipment, focusing on observing calibration processes, recording calibration data, and maintaining accurate records. Calibration ensures the precision and reliability of measurements, which is essential for the correct operation of equipment. You will learn how to identify discrepancies during calibration and how to maintain accurate records for future reference and compliance.

Ask

Ask the participants the following questions:

- What do you think might happen if equipment is not calibrated correctly before use?

Write down the participants' answers on a whiteboard/flipchart. Take appropriate clues from the answers and start teaching the lesson.

Elaborate

In this session, we will discuss the following points:

Observing Calibration Procedures (Elaborated):

- **Understanding Calibration Objectives:** Begin by recognizing the goal of calibration, which is to ensure the equipment operates accurately within defined parameters. Observers should focus on why each step is necessary to maintain precision and reliability.
- **Step-by-Step Process Review**: Watch as the qualified person performs specific tasks, such as checking baseline measurements, comparing them to reference standards, and making necessary adjustments. Each step validates that the equipment's performance aligns with technical requirements.
- **Significance of Adjustments:** Pay attention to adjustments made during calibration. These

modifications address any deviations identified during the process, ensuring that the equipment provides consistent and accurate readings in future use.

- **Verification and Documentation:** Observe how the final readings are verified against the standard to confirm successful calibration. Understand the importance of documenting each step for recordkeeping and compliance.

Recording Calibration Data:

Accurate documentation is essential during calibration. This includes recording the measured values, adjustments made, and any anomalies detected during the calibration process. If discrepancies are observed, they should be carefully noted. These discrepancies can indicate potential issues with the equipment, which need further investigation. Proper recording ensures traceability, accountability, and aids in the identification of recurring issues that may affect performance.

Maintaining Calibration Records:

Keeping detailed records of calibration activities is essential for quality control. This includes noting the date of calibration, the specific components calibrated, and any relevant observations during the process. Maintaining these records helps ensure that equipment is consistently calibrated according to schedule, and provides a reference for future calibrations or troubleshooting. Proper recordkeeping is also essential for compliance with industry standards and regulations.

Say

Let us participate in an activity to explore the unit a little more.

Activity

Group Activity: Simulating a Dicing Equipment Maintenance and Calibration Scenario

Group Size: 4–6 participants

Materials:

- Whiteboard or flipchart
- MarkersW
- Sticky notes (different colors)
- Scenario cards (described below)

Instructions:

1. **Divide Participants into Groups:** Form groups of 4–6 participants.
2. **Explain Objectives:** Clarify that the activity aims to enhance understanding of equipment maintenance, calibration, and identifying operational issues while emphasizing teamwork and safety.
3. **Distribute Scenario Cards:** Each group receives a unique scenario card detailing a hypothetical challenge related to equipment maintenance or calibration.

Group Discussion and Planning (20 minutes):

- Discuss the scenario using the following prompts:
    - What maintenance or calibration steps are relevant to address this scenario?

- What safety precautions should be followed during this process?
- How can the team identify and address potential operational issues effectively?
- Propose a step-by-step plan or solution to tackle the challenge.

Group Presentations (20 minutes):

- Each group presents their scenario, analysis, and proposed solutions.
- Encourage questions and discussions to promote collaborative learning.

Debriefing and Key Takeaways (20 minutes):

- Facilitate a discussion to summarize key insights.
- Focus on diverse approaches, the importance of safety and accuracy, and strategies for identifying and resolving issues efficiently.

Examples of Scenario Cards :

- **Scenario 1**: During routine cleaning, debris is discovered around the blade housing of the dicing equipment. The equipment needs cleaning and a minor calibration adjustment. How will the team ensure thorough cleaning and proper calibration without disrupting operations?
- **Scenario 2**: During calibration, discrepancies are observed between the equipment readings and standard parameters. What steps should the team take to identify and correct the source of the discrepancy while maintaining safety and accuracy?
- **Scenario 3**: A team member notices unusual noise during equipment operation, indicating a potential issue. How will the group address this concern to prevent further damage while ensuring workplace safety?

Activity	Duration	Resources used
Simulating a Dicing Equipment Maintenance and Calibration Scenario		Whiteboard or flipchart, Markers, Sticky notes (different colors), Scenario cards (described below) etc.

Do

- Guide the trainees throughout the activity
- Ensure that all trainees participate in the activity

Notes for Facilitation

- Encourage participants to focus on safety and teamwork while formulating their solutions.
- Guide discussions to ensure participants connect theoretical knowledge with practical application.
- Highlight the importance of accurate documentation and communication during maintenance and calibration processes.

Exercise

Multiple Choice Questions (MCQs)

1. What is the purpose of calibration in dicing equipment?

   a) Improve the appearance of the equipment

   b) Ensure consistent and accurate dicing performance

   c) Increase noise during operation

   d) Reduce the number of blades used

   Answer: b

2. What safety procedure ensures that equipment is completely de-energized before maintenance?

   a) Lubrication

   b) Tagging and coding

   c) Lockout/Tagout

   d) Speed adjustment

   Answer: c

3. What is the primary role of coolants in dicing equipment?

   a) Clean the blades

   b) Reduce friction and heat during operation

   c) Improve calibration accuracy

   d) Increase cutting force

   Answer: b

4. Which personal protective equipment (PPE) is essential for handling hazardous materials like cleaning solutions?

   a) Safety glasses and gloves

   b) Earplugs

   c) Steel-toed boots

   d) Respirators only

   Answer: a

Fill in the Blanks

1. The lockout/tagout procedure ensures that equipment is completely ________ before maintenance.

   Answer: de-energized

2. Excessive wear or strange noises during operation could indicate a potential ________ in the equipment.

   Answer: issue

3. Collecting and documenting yield data involves recording the count of _______ and defective outputs.

Answer: good

4. Calibration ensures the _______ of equipment performance over time.

Answer: accuracy

1. Match the Following:

1. Cleaning debris from equipment	a) Safety glasses and gloves
2. Dicing process parameters	b) Speed, force, blade type
3. PPE during blade handling	c) Basic maintenance procedure
4. Simulated calibration record	d) Includes date and observations
4. Reasons for Budget Deviations	D. Can include unexpected costs, miscalculations, or market changes

Answers 1 → c, 2 → b, 3 → a, 4 → d

2. Match the Following:

Column A	Column B
1.Lockout/Tagout procedure	A)Good/defect counts
2.Calibration	B) Coolants and cleaning solutions
3.Hazardous material handling	C)Ensures consistent dicing performance
4.Yield data documentation	D)Prevents accidental equipment startup

Answers 1.→ d), 2.→ c),3 → b),4.→ a)

5. Employability Skills

DGT/VSQ/N0102

Scan the QR codes or click on the link for the e-books

Employability Skills

https://www.skillindiadigital.gov.in/content/list

6. Annexures

Annexure: I
Annexure: II
Annexure: III

Annexure I
Training Delivery Plan

Program Name:	Assembly Process Supervisor- Wafer Dicing		
Qualification Pack and reference ID	Assembly Process Supervisor- Wafer Dicing- TEL/Q7204		
Version No.	1.0	Version Update Date	NA
Assembly Process Supervisor- Wafer Dicing- TEL/Q7204	NA		
Training Outcomes	**At the end of the program, the learner should have acquired the listed knowledge and skills to:** • Understand the SOPs and safety protocols for wafer dicing, including key process parameters and environmental conditions. • Demonstrate the ability to operate dicing equipment, selecting optimal blades and parameters for wafer cutting. • Analyze yield data to identify defects and correlate them with process conditions for continuous improvement. • Evaluate the success of process optimizations by comparing defect rates and yield data before and after changes. • Perform routine maintenance on dicing equipment, ensuring proper documentation and safety compliance.		

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
1.	Operate and Optimize Dicing Equipment	Unit 1.1: Semiconductor Wafer Materials and Their Impact on Dicing	• Explain the impact of different semiconductor wafer materials (e.g., silicon, silicon carbide) and their properties (hardness, brittleness) on the dicing process. • Discuss how wafer material properties influence chip quality and the dicing process.	TEL/N7212: Operate and Optimize Dicing Equipment	Interactive Lecture in the Class	Classroom Aids: Training kit (Trainer guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc. Tools, Equipment and Other Requirements Dicing Saw, Wafer Holding Fixture, Dicing Blade, (Optional: Different types of dicing blades like diamond, abrasive), Magnifying Glass, (Optional: Microscope for detailed inspection), Blade Wear Gauge, Reference Standards (e.g., Gauge Blocks), Personal Protective Equipment (PPE) * (Safety glasses, gloves,	T: 60:00 P: 60:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
						etc.), Computer or Dicing Software (for reference tables or parameter settings), (Optional: Data collection and analysis software)	
		Unit 1.2: Dicing Blade Selection and Safe Handling	• Explain the principles of selecting dicing blades based on wafer material and desired chip edge quality (smoothness, minimal chipping). • Compare and contrast different dicing blade types (diamond, abrasive) based on characteristics and suitability for various applications. • Describe safe handling procedures for dicing blades to minimize injury risks.		Interactive Lecture in the Class	Classroom Aids: Training kit (Trainer guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc. Tools, Equipment and Other Requirements Dicing Saw, Wafer Holding Fixture, Dicing Blade, (Optional: Different types of dicing blades like diamond, abrasive), Magnifying Glass,	T : 60:00 P : 60:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
						(Optional: Microscope for detailed inspection), Blade Wear Gauge, Reference Standards (e.g., Gauge Blocks), Personal Protective Equipment (PPE) * (Safety glasses, gloves, etc.), Computer or Dicing Software (for reference tables or parameter settings), (Optional: Data collection and analysis software)	
		Unit 1.3: Dicing Equipment Setup, Calibration, and Record Keeping	• Summarize the standard operating procedures (SOPs) for dicing equipment setup and calibration. • Describe the functionality and purpose of critical dicing equipment components (stage, blade holder, vibration dampener). • Explain the importance of accurate record-keeping during equipment setup and calibration.			Classroom Aids: Training kit (Trainer guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc. Tools, Equipment and Other Requirements Dicing Saw, Wafer Holding Fixture, Dicing Blade, Microscope for	T : 60:00 P : 60:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
						detailed inspection), Blade Wear Gauge, Reference Standards (e.g., Gauge Blocks), Personal Protective Equipment (PPE) * (Safety glasses, gloves, etc.), Computer or Dicing Software (for reference tables or parameter settings), (Optional: Data collection and analysis software)	
		Unit 1.4: Dicing Parameters and Their Influence on Process Efficiency	• Define and explain key dicing parameters (speed, force, blade selection) and their impact on throughput, chip quality, and blade wear. • Adjust dicing parameters based on process data and wafer inspection results.			Classroom Aids: Training kit (Trainer guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc. Tools, Equipment	T : 60:00 P : 60:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodo-logy	Training Tools Aids	Duration
						and Other Requireme-nts Dicing Saw, Wafer Holding Fixture, Dicing Blade, (Optional: Different types of dicing blades like diamond, abrasive), Magnifying Glass, (Optional: Microscope for Standards (e.g., Gauge Blocks), Personal Protective Equipment (PPE) * (Safety glasses, gloves, etc.), Computer or Dicing Software (for reference tables or parameter settings), (Optional: Data collection and analysis software)	

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
		Unit 1.5: Visual Inspection, Data Analysis, and Process Optimization	• Demonstrate techniques for visual inspection of diced wafers to identify chip damage and edge quality issues. • Utilize data analysis techniques to identify correlations between dicing parameters, chip quality, and throughput. • Apply iterative optimization principles to balance throughput with minimal chip damage.			Classroom Aids: Training kit (Trainer guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc. Tools, Equipment and Other Requirements Dicing Saw, Wafer Holding Fixture, Dicing Blade, (Optional: Different types of dicing blades like diamond, abrasive), Magnifying Glass, (Optional: Microscope for detailed inspection), Blade Wear Gauge, Reference Standards (e.g., Gauge Blocks),	T : 60:00 P : 60:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodo-logy	Training Tools Aids	Duration
						Personal Protective Equipment (PPE) * (Safety glasses, gloves, etc.), Computer or Dicing Software (for reference tables or parameter settings), (Optional: Data collection and analysis software)	
		Unit 1.6: Preventive Maintena-nce and Continuous Monitoring	• Record and analyze critical dicing process data (parameters, yield results, cycle time) to identify performance trends. • Correlate blade wear data with maintenance needs and plan preventive maintenance activities accordingly.			Classroom Aids: Training kit (Trainer guide, Presentati-ons), Whiteboard, Marker, Projector, Laptop, Presentati-on, Participant Handbook, etc. Tools, Equipment and Other Requireme-nts Dicing Saw, Wafer Holding Fixture,	T : 60:00 P : 60:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodo-logy	Training Tools Aids	Duration
						Dicing Blade, (Optional: Different types of dicing blades like diamond, abrasive), Magnifying Glass, (Optional: Microscope for detailed inspection), Blade Wear Gauge, Reference Standards (e.g., Gauge Blocks), Personal Protective Equipment (PPE) * (Safety glasses, gloves, etc.), Computer or Dicing Software (for reference tables or parameter settings), (Optional: Data collection and analysis software)	

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
2.	Dicing Blade Selection & Inventory Management	Unit 2.1: Dicing Blade Selection and Specifications	1. Demonstrate how to gather key information from wafer specification documents (material datasheet, chip design layout) to determine blade selection criteria. 2. Identify wafer material composition, thickness, and desired chip size from the specifications. 3. Select the appropriate dicing blade type (diamond, abrasive) based on compatibility, cost-effectiveness, and desired cutting performance.	TEL/N7213: Dicing Blade Selection & Inventory Management	Interactive Lecture in the Class	Classroom Aids: Training kit (Trainer guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc. Tools, Equipment and Other Requirements: Wafer Documents (material datasheet, chip design layout), Magnifying Glass, Blade Wear Gauge, Reference Standards (e.g., Gauge Blocks), Computer or Dicing Software (for reference tables or parameter settings) (Optional: Data collection and analysis software), Personal Protective Equipment (PPE) * (Safety glasses, gloves, etc.)	T: 30:00 P: 60:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
		Unit 2.2: Dicing Blade Inspection and Wear Detection	1. Explain the impact of wafer thickness on blade selection and potential chip edge quality issues. 2. Identify signs of wear and tear on dicing blades (chipped segments, reduced diameter, blade glazing) that may affect cutting performance. 3. Demonstrate the proper use of inspection tools (magnifying glass, blade wear gauge) to examine dicing blades for signs of wear. 4. Explain the importance of documenting inspection findings and blade condition (usable, requires replacement) for tracking purposes.		Interactive Lecture in the Class	Classroom Aids: Training kit (Trainer guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc. Tools, Equipment and Other Requirements: Wafer Specification Documents (material datasheet, chip design layout), Magnifying Glass, Blade Wear Gauge, Reference Standards (e.g., Gauge Blocks), Computer or Dicing Software (for reference tables or parameter settings) (Optional: Data collection and analysis software), Personal Protective Equipment (PPE) * (Safety glasses, gloves, etc.)	T: 30:00 P: 60:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
		Unit 2.3: Dicing Blade Maintenance and Inventory Management	1. Explain the importance of establishing a routine inspection schedule for dicing blades as per manufacturer's recommendations or company SOPs. 2. Explain the principles of inventory management, including establishing minimum and maximum inventory levels based on usage patterns and lead times. 3. Utilize designated tracking systems (e.g., inventory management software, physical inventory checks) to monitor current blade inventory levels (quantity, type). 4. Initiate blade procurement processes (purchase orders) to ensure sufficient stock before depletion when inventory levels fall below the minimum threshold.			Classroom Aids: Training kit (Trainer guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc. Tools, Equipment and Other Requirements: Wafer Specification Documents (material datasheet, chip design layout), Magnifying Glass, Blade Wear Gauge, Reference Standards (e.g., Gauge Blocks), Computer or Dicing Software (for reference tables or parameter settings) (Optional: Data collection and analysis software), Personal Protective Equipment (PPE) * (Safety glasses, gloves, etc.)	T: 30:00 P: 60:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
		Unit 2.4: Storage, Handling, and Disposal of Dicing Blades	1. Explain the importance of proper storage conditions for dicing blades (humidity control, dust-free environment) to maintain optimal performance and lifespan. 2. Demonstrate how to safely handle dicing blades during inventory management activities (receiving, storing, issuing) following proper procedures. 3. Describe safe and environmentally responsible disposal procedures for used or worn-out dicing blades.			Classroom Aids: Training kit (Trainer guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc. Tools, Equipment and Other Requirements: Wafer Specification Documents (material datasheet, chip design layout), Magnifying Glass, Blade Wear Gauge, Reference Standards (e.g., Gauge Blocks), Computer or Dicing Software (for reference tables or parameter settings) (Optional: Data collection and analysis software), Personal Protective Equipment (PPE) * (Safety glasses, gloves, etc.)	T: 30:00 P: 60:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
		Unit 2.5: Blade Wear Monitoring and Process Optimization	1. Explain the importance of monitoring dicing blade wear for ensuring consistent performance and optimal throughput. 2. Discuss the relationship between blade wear and cutting efficiency, and how this impacts overall dicing quality. 3. Demonstrate how to adjust dicing parameters based on inspection findings to optimize the blade's lifespan and cutting performance.			Classroom Aids: Training kit (Trainer guide, Presentations), Whiteboard, Marker, Projector, Laptop, Presentation, Participant Handbook, etc. Tools, Equipment and Other Requirements: Wafer Specification Documents (material datasheet, chip design layout), Magnifying Glass, Blade Wear Gauge, Reference Standards (e.g., Gauge Blocks), Computer or Dicing Software (for reference tables or parameter settings) (Optional: Data collection and analysis software), Personal Protective Equipment (PPE) * (Safety glasses, gloves, etc.)	

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodo-logy	Training Tools Aids	Durati-on
3.	Dicing Yield Analysis & Optimizat-ion	Unit 3.1: Dicing Process and Yield Analysis	• Explain how dicing process steps (e.g., sawing, cleaning) can impact wafer yield. • Identify common dicing defects (chipping, cracking, surface contamination) based on descriptions and visuals. • Explain the correlation between different defect types and potential causes in the dicing process. • Analyze sample data sets to understand the frequency and distribution of defect types.	TEL/N7214: Dicing Yield Analysis & Optimization	Interactive Lecture in the Class	Classroom Aids: Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films Tools, Equipment and Other Requirements Computers with data analysis software (spreadsheets or statistical analysis software), Projectors or screens, Whiteboards or flipcharts, Sample data sets related to dicing yield (can be paper-based or electronic), Simulated reports or logs for process parameters and equipment data (paper-based or electronic), Optional: Physical samples of diced wafers (for illustrative purposes only, not for actual analysis)	T: 30:00 P: 30:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
		Unit 3.2: Process Data Interpretation and Defect Identification	1. Explain how to interpret process data and equipment logs to identify potential causes of yield issues. 2. Compare yield data with simulated process parameters and equipment logs to identify potential correlations. 3. Prioritize yield issues based on their severity and impact on overall yield using simulated scenarios.		Interactive Lecture in the Class	Classroom Aids: Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films Tools, Equipment and Other Requirements Computers with data analysis software (spreadsheets or statistical analysis software), Projectors or screens, Whiteboards or flipcharts, Sample data sets related to dicing yield (can be paper-based or electronic), Simulated reports or logs for process parameters and equipment data (paper-based or electronic), Optional: Physical samples of diced wafers (for illustrative purposes only, not for actual analysis)	T: 30:00 P: 30:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodology	Training Tools Aids	Duration
		Unit 3.3: Collaboration and Communication for Yield Improvement	1. Discuss the importance of clear communication and collaboration with different teams (process engineers, quality control) to share data and expertise. 2. Role-play initiating discussions with simulated cross-functional teams (process engineers, quality control) to share yield data and defect analysis. 3. Participate in group discussions and activities to brainstorm and propose potential solutions for identified yield issues.		Interactive Lecture in the Class	Classroom Aids: Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films Tools, Equipment and Other Requirements Computers with data analysis software (spreadsheets or statistical analysis software), Projectors or screens, Whiteboards or flipcharts, Sample data sets related to dicing yield (can be paper-based or electronic), Simulated reports or logs for process parameters and equipment data (paper-based or electronic), Optional: Physical samples of diced wafers (for illustrative purposes only, not for actual analysis)	T: 30:00 P: 30:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Method-ology	Training Tools Aids	Durati-on
		Unit 3.4: Yield Improvement Strategies and Implementation	1. Describe various strategies for improving dicing yield, such as adjusting process parameters, modifying equipment settings, and implementing new cleaning procedures. 2. Evaluate proposed solutions considering factors like feasibility, cost-effectiveness, and potential impact on other process parameters. 3. Develop a documented action plan for yield improvement based on classroom discussions and activities. 4. Define clear tasks and responsibilities for implementing the chosen strategies.			Classroom Aids: Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films Tools, Equipment and Other Requirements Computers with data analysis software (spreadsheets or statistical analysis software), Projectors or screens, Whiteboards or flipcharts, Sample data sets related to dicing yield (can be paper-based or electronic), Simulated reports or logs for process parameters and equipment data (paper-based or electronic), Optional: Physical samples of diced wafers (for illustrative purposes only, not for actual analysis)	T: 30:00 P: 30:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Method-ology	Training Tools Aids	Durati-on
		Unit 3.5: Post-Implementation Assessment and Documentation	• Explain how to interpret post-implementation yield data to assess the effectiveness of corrective actions. • Explain the importance of documenting and sharing improvement results with relevant teams to facilitate ongoing yield optimization.			Classroom Aids: Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films Tools, Equipment and Other Requirements Computers with data analysis software (spreadsheets or statistical analysis software), Projectors or screens, Whiteboards or flipcharts, Sample data sets related to dicing yield (can be paper-based or electronic), Simulated reports or logs for process parameters and equipment data (paper-based or electronic), Optional: Physical samples of diced wafers (for illustrative purposes only, not for actual analysis)	T: 30:00 P: 30:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Method-ology	Training Tools Aids	Durat-on
4	Dicing Equipment Maintenance & Reporting	Unit 4.1: Equipment Maintenance and Calibration	• Explain the importance and components of manufacturer's recommended maintenance schedules for dicing equipment. • Describe basic cleaning and lubrication procedures for dicing equipment components. • Explain the importance of calibration for maintaining consistent dicing performance. • Identify potential causes of unusual observations during maintenance, such as excessive wear, loose components, or strange noises. • Explain the role of assisting qualified personnel with calibration procedures, including the purpose of recording data. • Demonstrate how to review manufacturer's recommended maintenance schedules and identify specific components requiring maintenance.	TEL/N7215: Dicing Equipment Maintenance & Reporting	Interacti-ve Lecture in the Class	Classroom Aids: Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films Tools, Equipment and Other Requirements Safety glasses, Non-abrasive wipes or cloths, Compressed air (can be simulated with a hand pump), Small screwdrivers (for non-electrical tasks), Brushes (soft bristle), Consumable replacements (simulated or spare parts) - lubricants, coolants (in sealed containers), Sample calibration tools (may be mock-ups or non-functional for safety), Recording sheets for simulated calibration data, Computers with sample data entry software (if applicable), Sample reports and data sheets	T: 30:00 P: 30:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Method-ology	Training Tools Aids	Durati-on
		Unit 4.2: Dicing Process Parameters and Data Documentation	• Explain how dicing process parameters (speed, force, blade type) affect results. • Describe methods for collecting and documenting yield data (good/defect counts). • Identify trends and potential issues in yield data through explanation. • Explain company procedures for recording data, generating reports, and storing records.		Interactive Lecture in the Class	Classroom Aids: Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films Tools, Equipment and Other Requirements Safety glasses, Non-abrasive wipes or cloths, Compressed air (can be simulated with a hand pump), Small screwdrivers (for non-electrical tasks), Brushes (soft bristle), Consumable replacements (simulated or spare parts) - lubricants, coolants (in sealed containers), Sample calibration tools (may be mock-ups or non-functional for safety), Recording sheets for simulated calibration data, Computers with sample data entry software (if applicable), Sample reports and data sheets	T: 30:00 P: 30:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Method-ology	Training Tools Aids	Durati-on
		Unit 4.3: Safety Protocols and Hazard Manageme-nt	• Describe safe operating procedures for dicing equipment (lockout/tagout, blade handling). • Explain regulations for handling hazardous materials used during dicing (coolants, cleaning solutions). • Explain how to identify potential safety hazards in the dicing workplace (electrical, slipping). • Explain the proper use and maintenance of personal protective equipment (PPE).			Classroom Aids: Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films Tools, Equipment and Other Requirements Safety glasses, Non-abrasive wipes or cloths, Compressed air (can be simulated with a hand pump), Small screwdrivers (for non-electrical tasks), Brushes (soft bristle), Consumable replacements (simulated or spare parts) - lubricants, coolants (in sealed containers), Sample calibration tools (may be mock-ups or non-functional for safety), Recording sheets for simulated calibration data, Computers with sample data entry software (if applicable), Sample reports and data sheets	T: 30:00 P: 30:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodo-logy	Training Tools Aids	Durati-on
		Unit 4.4: Cleaning, Lubrication, and Consumables Maintenance	1. Perform basic cleaning tasks on simulated or non-operational dicing equipment as per guidelines (e.g., dust removal, debris cleaning). 2. Perform replenishment or replacement of consumables according to a simulated schedule (e.g., lubricants, coolants). 3. Apply knowledge to differentiate between normal operation and potential issues based on audio or video recordings of dicing equipment.			Classroom Aids: Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films Tools, Equipment and Other Requirements Safety glasses, Non-abrasive wipes or cloths, Compressed air (can be simulated with a hand pump), Small screwdrivers (for non-electrical tasks), Brushes (soft bristle), Consumable replacements (simulated or spare parts) - lubricants, coolants (in sealed containers), Sample calibration tools (may be mock-ups or non-functional for safety), Recording sheets for simulated calibration data, Computers with sample data entry software (if applicable), Sample reports and data sheets	T: 30:00 P: 30:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodo-logy	Training Tools Aids	Durati-on
		Unit 4.5: Calibration Procedures and Record Keeping	• Observe a qualified person performing calibration procedures and explain the purpose of specific steps. • Record simulated calibration data and report any discrepancies observed during the process. • Maintain records of simulated calibration activities, including the date, equipment components calibrated, and any relevant observations.			Classroom Aids: Training Kit - Trainer Guide, Presentations, Whiteboard, Marker, Projector, Laptop, Video Films Tools, Equipment and Other Requirements Safety glasses, Non-abrasive wipes or cloths, Compressed air (can be simulated with a hand pump), Small screwdrivers (for non-electrical tasks), Brushes (soft bristle), Consumable replacements (simulated or spare parts) - lubricants, coolants (in sealed containers), Sample calibration tools (may be mock-ups or non-functional for safety), Recording sheets for simulated calibration data, Computers with sample data entry software (if applicable), Sample reports and data sheets	T: 30:00 P: 30:00

S. No.	Module Name	Session Name	Session Objectives	NOS Reference	Methodo-logy	Training Tools Aids	Durati-on
8	Employabi-lity Skills	Employability Skills		DGT/VSQ/ N0103: Employability Skills (90 Hours	Interacti-ve Lecture in the Class	Employability Skills Participant handbook, Projector Whiteboard, Marker, and Duster	90 Hours
9	On-the-Job Training						180 Hours

Annexure II

Assessment Criteria

CRITERIA FOR ASSESSMENT OF TRAINEES

Job Role	Assembly Process Technician – Wafer Dicing
Qualification Pack	TEL/Q7204
Sector Skill Council	Telecom Sector Skill Council

S. No.	Assessment Guidelines
1.	Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Element/ Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each Element/ PC.
2.	The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3.	Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.
4.	Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below).
5.	Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/ training center based on these criteria.
6.	To pass the Qualification Pack assessment, every trainee should score the Recommended Pass 70 % aggregate for the QP.
7.	In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

NOS	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
TEL/N212: Optimize Dicing Process	Prepare Dicing Equipment and Set Up Process	14	30	-	5
	Pc1. review wafer specification documents (material datasheet, chip design layout) to gather relevant information	2	3	-	1
	PC2. identify relevant wafer parameters (material composition, thickness, desired chip dimensions) for dicingprofessional manner	1	3	-	-
	PC3. build effective yet impersonal relationship with guests	1	3	-	1
	PC4. consult reference tables or software to determine initial dicing parameter settings (speed, force, etc.) considering wafer properties and blade selection	1	3	-	1
	PC5. prepare the dicing equipment work area according to SOPs (cleanliness, organization)	2	3	-	-
	PC6. mount the wafer securely onto the dicing stage using appropriate holding fixtures as per SOPs	1	3	-	-
	PC7. install the selected dicing blade following safe handling procedures to avoid injury	3	5	-	1
	PC8. perform calibration procedures for dicing equipment components (stage movement accuracy, blade tension, vibration control) as per manufacturer's instructions	2	4	-	-
	PC9. verify calibration accuracy using reference standards (e.g., gauge blocks)	1	3	-	1
	Execute and Optimize Dicing Process	16	30	-	5
	PC10. run initial test dicing cycles with pre-determined parameters	3	5	-	1
	PC11. inspect diced wafers for chip damage (cracking, chipping) and edge quality	2	3	-	-
	PC12. analyze process data (throughput, cycle time) collected during test runs	2	4	-	-
	PC13. adjust dicing parameters (speed, force, blade selection if necessary), based on analysis, to achieve: a. high throughput (maximize wafer processing rate) b. minimal chip damage (maintain chip quality)	3	6	-	-
	PC14. repeat test dicing cycles with adjusted parameters and continue iteratively optimizing for best results	1	3	-	-

NOS	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	PC15. monitor dicing process parameters and equipment performance during operation continuously	1	3	-	-
	PC16. record dicing process data (parameters used, yield results, cycle time, blade wear indicators) in designated formats (e.g., logs, electronic records)	2	3	-	1
	PC17. analyze recorded data to identify trends, potential areas for further optimization, and opportunities for preventive maintenance (based on blade wear data)	2	3	-	3
	NOS Total	**30**	**60**	-	**10**
TEL/ N213: Selecting & Managing Cutting Tools	Select Appropriate Dicing Blades	12	30	-	5
	PC1. review wafer specification documents (material datasheet, chip design layout) to obtain key information	2	5	-	1
	PC2. determine the wafer material composition (e.g., silicon, sapphire) and thickness from the specifications	3	6	-	1
	PC3. identify the desired chip size (dimensions) from the chip design layout	1	4	-	1
	PC4. determine the required edge quality for the diced chips (e.g., smoothness, minimal chipping) based on application needs	1	4	-	-
	PC5. consult blade selection guide or manufacturer recommendations based on identified wafer material and desired chip characteristics	3	6	-	1
	PC6. select appropriate dicing blade type (e.g., diamond, abrasive) considering compatibility, cost-effectiveness, and desired cutting performance	2	5	-	1
	Dicing Blade Maintenance and Inventory Management	18	30	-	5
	PC7. establish a routine inspection schedule for dicing blades as per manufacturer's recommendations or company SOPs	2	3	-	1
	PC8. visually inspect blades for any signs of wear and tear that may affect cutting performance.	1	3	-	-
	PC9. utilize appropriate inspection tools (e.g., magnifying glass, blade wear gauge) for detailed examination	2	4	-	1
	PC10. document inspection findings and blade condition (usable, requires replacement)	3	3	-	-

NOS	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	PC11. establish minimum and maximum inventory levels for different types of dicing blades based on usage patterns and lead times for procurement	2	3	-	1
	PC12. monitor current blade inventory levels (quantity, type) through a designated tracking system (e.g., inventory management software, physical inventory checks)	3	4	-	1
	PC13. initiate blade procurement processes (purchase orders) when inventory levels fall below the minimum threshold to ensure sufficient stock before depletion	2	3	-	-
	PC14. maintain proper storage conditions for dicing blades according to manufacturer's recommendations (e.g., humidity control, dust-free environment)	1	3	-	1
	PC15. properly dispose of used or worn-out blades following established safety and environmental regulations	2	4	-	-
	NOS Total	**30**	**60**	-	**10**
TEL/N214: Dicing Yield Analysis & Optimization	Dicing Yield Analysis & Strategy Development	16	30	-	5
	PC1. collect diced wafer yield data from various sources (e.g., process monitoring systems, inspection reports)	2	4	-	1
	PC2. identify patterns and trends in defect types observed in the yield data (e.g., chipping, cracking, contamination)	2	2	-	-
	PC3. analyze the frequency and distribution of each defect type across different batches or wafers	1	2	-	-
	PC4. compare yield data with process parameters and equipment logs from corresponding dicing jobs	2	4	-	1
	PC5. identify potential correlations between specific process settings (speed, force, blade type) and observed defect types	2	2	-	-
	PC6. prioritize yield issues based on their severity and impact on overall yield	1	2	-	-
	PC7. initiate discussions with cross-functional teams (process engineers, quality control) to share yield data and defect analysis	2	4	-	1
	PC8. brainstorm and propose potential solutions for identified yield issues based on expertise of each team	1	3	-	1
	PC9. evaluate proposed solutions considering factors like feasibility, cost-effectiveness, and potential impact on other process parameters	1	2	-	-

NOS	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	Pc10. develop and document a collaborative action plan for yield improvement	1	3	-	1
	PC11. define clear tasks, responsibilities, and timelines for implementing the chosen strategies	1	2	-	-
	Implementation & Monitoring of Corrective Actions	14	30	-	5
	PC12. implement the agreed-upon corrective actions for yield improvement (e.g., adjust process parameters, modify equipment settings, implement new cleaning procedures)	2	4	-	1
	PC13. ensure clear communication and coordination with personnel responsible for implementation	1	3	-	-
	PC14. collect new yield data after implementing the corrective actions	2	4	-	1
	PC15. monitor the impact of implemented changes on defect occurrence and overall yield percentagecaring and respecting others, etc.	2	5	-	1
	PC16. assess the effectiveness of the corrective actions based on the collected data	2	4	-	-
	PC17. identify if further adjustments or modifications are necessary to achieve optimal yield	2	4	-	1
	PC18. document the results of the implemented actions and their impact on yield improvement	2	3	-	1
	PC19. share the information with relevant teams to facilitate continuous yield improvement and knowledge sharing	1	3	-	-
	NOS Total	**30**	**60**	-	**10**
TEL/N215: Dicing Equipment Maintenance & Reporting	Perform Preventive Maintenance & Calibration	18	24	-	4
	PC1. review manufacturer's recommended maintenance schedule for dicing equipment	1	1	-	1
	PC2. identify and locate specific components requiring maintenance (e.g., bearings, filters, blades)	2	2	-	-
	PC3. perform basic cleaning tasks on the dicing equipment as per guidelines (e.g., dust removal, debris cleaning)	2	3	-	-
	PC4. replenish or replace consumables according to the schedule (e.g., lubricants, coolants)	1	2	-	-

NOS	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	PC5. utilize knowledge of typical dicing equipment operation sounds and vibration levels to differentiate between normal operation and potential issues.	2	3	-	1
	PC6. report any unusual observations during maintenance activities, such as excessive wear, loose components, or strange noises	2	2	-	-
	PC7. assist qualified personnel during scheduled calibration procedures for dicing equipment components	1	2	-	-
	PC8. identify the purpose and function of each calibration step being performed (e.g., stage movement calibration ensures precise blade positioning)	2	2	-	1
	PC9. record calibration data (measurements, adjustments made) on designated forms or electronic systems	2	2	-	-
	PC10. report any discrepancies or unexpected results observed during calibration to the qualified personnel	2	2	-	1
	PC11. maintain records of calibration activities, including the date, equipment components calibrated, and any relevant observations	1	2	-	-
	Maintain Up-to-Date Records & Reports	14	14	-	3
	PC12. record dicing process parameters (speed, force, blade type) in designated formats (e.g., logs, electronic data entry) during dicing operation	2	2	-	1
	PC13. collect and document yield data (good/defect counts) after dicing process completion	1	1	-	-
	PC14. maintain accurate records of equipment maintenance activities (date, tasks) performed	1	1	-	-
	PC15. regularly review recorded data for accuracy and completeness	**1**	**1**	-	-
	PC16. update records promptly to reflect any changes or corrections identified	1	1	-	-
	PC17. prepare reports summarizing dicing process performance metrics (throughput, yield percentage)	1	1	-	-
	PC18. analyze yield data to identify trends and potential areas for improvement	1	1	-	-

NOS	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	PC19. generate reports on equipment maintenance and any corrective actions	1	1	-	1
	PC20. submit reports on dicing process performance following established channels	1	1	-	-
	PC21. review and thoroughly understand company policies and procedures related to documentation and record-keeping for dicing operations	1	1	-	-
	PC22. follow company-defined formats and procedures for recording dicing process data and generating reports	1	1	-	-
	PC23. ensure data entries are clear, concise, and verifiable by others	1	1	-	-
	PC24. properly store and archive dicing process records according to company guidelines Comply with Safety Protocols	2	2	-	-
	Comply with Safety Protocols	8	12	-	3
	PC25. follow established safety protocols for operating dicing equipment (e.g., lockout/tagout procedures, proper blade handling)	2	3	-	1
	PC26. identify and adhere to safety regulations for handling hazardous materials potentially used during dicing (e.g., coolants, cleaning solutions)	2	2	-	-
	PC27. identify potential safety hazards (e.g., electrical risks, slipping hazards) and be observant of the dicing work environment	1	2	-	1
	PC28. report identified safety hazards to supervisors or designated personnel for corrective action	1	2	-	-
	PC29. wear appropriate PPE (e.g., safety glasses, gloves, ear protection) as mandated by company safety regulations for dicing operations	1	2	-	1
	PC30. ensure PPE is properly fitted, maintained, and in good working condition	1	1	-	-
	NOS Total	**40**	**50**	-	**10**

NOS	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
DGT/VSQ/N0103: Employability Skills (90 Hours)	Introduction to Employability Skills	1	1	-	-
	PC1.understand the significance of employability skills in meeting the current job market requirement and future of work	-	-	-	-
	PC2.identify and explore learning and employability relevant portals	-	-	-	-
	PC3.research about the different industries, job market trends, latest skills required and the available opportunities	-	-	-	-
	Constitutional values – Citizenship	1	1	-	-
	PC4.recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-	-
	PC5.follow environmentally sustainable practices	-	-	-	-
	Becoming a Professional in the 21st Century	1	3	-	-
	PC6.recognize the significance of 21st Century Skills for employment	-	-	-	-
	PC7.practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life	-	-	-	-
	PC8.adopt a continuous learning mindset for personal and professional development	-	-	-	-
	Basic English Skills	**3**	**4**	-	-
	PC9.use basic English for everyday conversation in different contexts, in person and over the telephone	-	-	-	-
	PC10. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-	-
	PC11. write short messages, notes, letters, e-mails etc. in English	-	-	-	-
	Career Development & Goal Setting	1	2	-	-
	PC12. identify career goals based on the skills, interests, knowledge, and personal attributes	-	-	-	-
	PC13. prepare a career development plan with short- and long-term goals	-	-	-	-

NOS	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	Communication Skills	2	2	-	-
	PC14. follow verbal and non-verbal communication etiquette while communicating in professional and public settings	-	-	-	-
	PC15. use active listening techniques for effective communication	-	-	-	-
	PC16. communicate in writing using appropriate style and format based on formal or informal requirements	-	-	-	-
	PC17. work collaboratively with others in a team	-	-	-	-
	Diversity & Inclusion	1	1	-	-
	PC18. communicate and behave appropriately with all genders and PwD	-	-	-	-
	PC19. escalate any issues related to sexual harassment at workplace according to POSH Act	-	-	-	-
	Financial and Legal Literacy	2	3	-	-
	PC20. identify and select reliable institutions for various financial products and services such as bank account, debit and credit cards, loans, insurance etc.	-	-	-	-
	PC21. carry out offline and online financial transactions, safely and securely, using various methods and check the entries in the passbook	-	-	-	-
	PC22. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-	-
	PC23. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-	-
	Essential Digital Skills	3	5	-	-
	PC24. operate digital devices and use their features and applications securely and safely	-	-	-	-
	PC25. carry out basic internet operations by connecting to the internet safely and securely, using the mobile data or other available networks through Bluetooth, Wi-Fi, etc.	-	-	-	-
	PC26. display responsible online behaviour while using various social media platforms				
	PC27. create a personal email account, send and process received messages as per requirement	-	-	-	-

NOS	Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
	PC28. carry out basic procedures in documents, spreadsheets and presentations using respective and appropriate applications	-	-	-	-
	PC29. utilize virtual collaboration tools to work effectively	-	-	-	-
	Entrepreneurship	2	3	-	-
	PC30. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research	-	-	-	-
	PC31. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-	-
	PC32. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity	-	-	-	-
	Customer Service	1	2	-	-
	PC33. identify different types of customers and ways to communicate with them	-	-	-	-
	PC34. identify and respond to customer requests and needs in a professional manner	-	-	-	-
	PC35. use appropriate tools to collect customer feedback	-	-	-	-
	PC36. follow appropriate hygiene and grooming standards	-	-	-	-
	Getting ready for apprenticeship & Jobs	2	3	-	-
	PC37. create a professional Curriculum vitae (Résumé)	-	-	-	-
	PC38. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-	-
	PC39. apply to identified job openings using offline /online methods as per requirement	-	-	-	-
	PC40. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-	-
	PC41. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-	-
	NOS Total	**20**	**30**	-	-

Annexure III

List of QR Codes Used in PHB

Module No.	Unit No.	Topic Name	Page No.	Link to QR Code	QR code
Module 1: Operate and Optimize Dicing Equipment	Unit 1.1: Semiconductor Wafer Materials and Their Impact on Dicing	1.1.1: Explain the impact of different semiconductor wafer materials (e.g., silicon, silicon carbide) and their properties (hardness, brittleness) on the dicing process.	22	https://youtu.be/MpSgg2gWSsU?si=CHDLRjhIBx1LY-Cq	Silicon Carbide
	Unit 1.3: Dicing Equipment Setup, Calibration, and Record Keeping	1.2.3: Explain the importance of accurate record-keeping during equipment setup and calibration.	22	https://youtu.be/SFOSEFp9yEU?si=5v6NlrZ-T1g9ORiC	What is Device Calibration
	Unit 1.5: Visual Inspection, Data Analysis, and Process Optimization	1.5.1: Demonstrate techniques for visual inspection of diced wafers to identify chip damage and edge quality issues.	22	https://youtu.be/m4G55qtt6KA?si=rnva8nuPG5Uk8vWd	Damage identification by visual Inspection method
	Unit 1.6: Preventive Maintenance and Continuous Monitoring	1.6.1: Record and analyze critical dicing process data (parameters, yield results, cycle time) to identify performance trends.	38	https://youtu.be/5sWHloL87P8?si=R0gUGLsj6AzIBls	Process Parameter

Module No.	Unit No.	Topic Name	Page No.	Link to QR Code	QR code
Module 2: Dicing Blade Selection & Inventory Management	Unit 2.1: Dicing Blade Selection and Specifications	2.1.2: Identify wafer material composition wafer material composition, thickness, and desired chip size from the specifications.	22	https://youtu.be/m7vscl_NEoU?si=yyWZyJr0OsaLXhpL	Wafer Material Composition
	Unit 2.3: Dicing Blade Maintenance and Inventory Management	2.3.1: Explain the importance of establishing a routine inspection schedule for dicing blades as per manufacturer's recommendations or company SOPs.	22	https://youtu.be/_OSxe_lKWz0?si=hpSwVpn830rZG-rq	Standard Operating Procedures (SOPs)
	Unit 2.5: Blade Wear Monitoring and Process Optimization	2.5.2: Discuss the relationship between blade wear and cutting efficiency, and how this impacts overall dicing quality.	22	https://youtu.be/YdPT4oPz2Mk?si=jdvUHzFVzbC3Z2Lu	Types of cutting fluids
Module 3: Dicing Yield Analysis & Optimization	Unit 3.1: Dicing Process and Yield Analysis	3.1.1: Explain how dicing process steps (e.g., sawing, cleaning) can impact wafer yield.	38	https://youtu.be/aWKGIVM8RuU?si=K3FlxRjheKrEzkZD	Wafer Sawing

Module No.	Unit No.	Topic Name	Page No.	Link to QR Code	QR code
	Unit 3.3: Collaboration and Communication for Yield Improvement	3.3.2: Role-play initiating discussions with simulated cross-functional teams (process engineers, quality control) to share yield data and defect analysis.	22	https://youtu.be/G6M-YGolxeA?si=QrObqNAWk8oRjWan	Yield Analysis
	Unit 3.5: Post-Implementation Assessment and Documentation	3.5.2: Explain how to interpret post-implementation yield data to assess the effectiveness of corrective actions.	22	https://youtu.be/iM1IOdtO5Rk?si=IqOUzi5KdXxLiVbh	Effective Corrective Action Responses
Module 4: Dicing Equipment Maintenance & Reporting	Unit 4.1: Equipment Maintenance and Calibration	4.1.2: Describe basic cleaning and lubrication procedures for dicing equipment components.	22	https://youtu.be/miLLLV62QwM?si=jZVTgZ42Bx16iguk	Lubrication Basics
	Unit 4.3: Safety Protocols and Hazard Management	4.3.1: Describe safe operating procedures for dicing equipment (lockout/tagout, blade handling).	38	https://youtu.be/WwiLVzRmisg?si=EwoscMrGQWeG82fV	LOTO- Lock Out Tag Out

Module No.	Unit No.	Topic Name	Page No.	Link to QR Code	QR code
	Unit 4.5: Calibration Procedures and Record Keeping	4.5.2: Record simulated calibration data and report any discrepancies observed during the process.	22	https://youtu.be/ejmt1atj0XY?si=Usyw2CJlzfgVvYM9	Calibration Process

कौशल गुणवत्ता प्रगति

Skill India
कौशल भारत-कुशल भारत

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Transforming the skill landscape

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