INDUSTRIAL SAFETY for Semiconductors Manufacturing

(Can apply to Display and Nanotechnology/ Process and Manufacturing Engineering Industries as a foundation course)

Course Outcomes:

At the end of the course, students will be able to:

1 Apply standard safety procedures in an industrial environment (specific focus on semiconductor industry/nanotech manufacturing process industry).
2 Be familiar with standard workplace hazard/warning signs and labels.
3 Be familiar with standard categories of hazardous materials.
4 Identify hazard and potential hazard areas.
5 Develop safety programs to prevent or mitigate damage or losses.
6 Assess safety practices and programs.
7 Conduct safety audits and improve safety practices.

Unit 1: Hazchem Safety in Semiconductor Industry (safety in process industries) (9 hours soft training / 3 hours hands-on including 2 hr exam; 1 hr viva/practical)
Overview of Hazards associated with Hazardous Production materials (HPMs) and FAB Tool safety. GHS classification & labelling of Chemicals; Communication, Control and Emergency procedures; Types of Hazchem Labels; Hazchem Hazards; SDKs and how to use them; Extremely Hazardous Chemicals; Hazchem Hazards in different stages of semiconductor/nanotech manufacturing process, Controls and Emergency Actions; Precautions from Hazchem; Hazchem PPE –selection, correct use, and disposal; Emergency Hazchem procedures; Safety Shower Systems; Hazardous chemicals and control systems.

Requirements for Liquid Leak Detection system and spill containment for FAB tools.

Unit 2: Electric Safety in Semiconductor Manufacturing Industry (10 hours soft training/6 hrs hands-on including 2 hr exam; 1 hr viva/practical)
Fundamentals of electric risk for humans; Electric safety principles; Implementing Electric safety programs; LOTO; Electric hazards in semiconductor industry; Earthing; PPE for Electric Safety; Emergency Guidelines; Electric safety program principles

Arc flash – what it is, why it is relevant for Semiconductor electric safety; Labelling; PPE – correct selection, correct use; Precautions; Emergency Guidelines and procedures.

Unit 3: Semiconductor Factory Operations safety (safety in engineering industries) (12 hours soft training/ 4 hours hands-on including 2 hr exam; 2 hr viva/practical)
Risk, Safety & Emergency Process while
Working with hands/hands safety; ladder safety; working with semiconductor process chambers and tools, vacuum pumps, gas panels and delivery systems; Work Safety Procedures & Practices for Safe Handling of Gas & Chemicals.

Safety Culture/ Safety audits/ Permit to Work System.

Requirement for Safe Storage of confined space; Working with forklifts/ Safety Principles; working with power tools; Requirement for Safe Storage of Chemical & Gas Cylinders in use in Semiconductor Fab, working with conveyers.

Fixed Toxic Gas Detection system, selection and positioning of Toxic Gas sensors and requirement for portable personal gas detectors.

Fire Triangle; Fire prevention and firefighting, equipment, and methods. Requirements for Fire Protection & Detection system and setting up of centralised Fire Command Control Room

Unit 4: Semiconductor Office Ergonomics & Environment, Health & Safety (EHS) (Safety in office) (4 hours including 30 min exam; 30 min viva/practical)
Office Health Hazards, Office ergonomics and safety checklists and procedures

Unit 5: Semiconductor Hazardous Energy Control (6 hrs soft training with 2 hrs hands-on including 1 hr exam; 1 hr practical LOTO)
Hazardous Energy Sources; Lock Out/ Tag Out procedures; Testing for latent energy risks; discharge of energy and control of hazardous energy; Safety Procedures for control and for emergencies.

Unit 6: Safety Basics and Law (8 hrs including 1 hrs exams + 1 hr Viva/case analysis)
Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, Statutory Compliances in respect of Storage & Handling Bulk Gases, Gas Cylinders Rules, Petroleum Rules, Occupational Health Safety Code Act 2020 (OSHA), SESHA.

Introduction to Building Fire Safety Code requirements in India / International for setting up of semiconductor facility.

Washrooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety colour codes.

Unit 7: Maintenance Engineering Basics 1 (3 hr soft training with 30 min exam)
Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relationship with replacement economy, Service life of equipment.

Unit 8: Maintenance Engineering Basics 2 (2 hr soft training with 2 hr hands-on; including 30 min exam, 30 min viva/practical)

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle, and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit 9: Fault tracing, Safety Audits (2 hr soft training with 2 hr hands-on; including 30 min exam, 30 min viva/practical)

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal, and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Unit 10: Maintenance Engineering Basics 3 (2 hr soft training with 2 hr hands-on; including 30 min exam, 30 min viva/practical)

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning, and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps, and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program, and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

Unit 11: First Responder Team Basics (16 hrs – 8 hrs soft training; 8 hrs hands-on trainings including 1+1 hrs of exam/practical)
Emergency Processes, First Responder Trainings, First Aid and CPR, Limits of First Responder engagement

References:

Hands-on training

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Job Role	QP Unit Stack	Comments
Electric Safety Officer	Unit 2,3,4,5,6, 11 Technician	All Units - Safety Specialist Min 2-year workex Expert Revalidation of certification based on credits based on continued workex; recertification exam; industry conference /paper credit (norm to be announced by ESSCI committee)
HazChem Safety Officer	Unit 1, 3, 4, 5, 6, 11 Technician	All Units - Safety Specialist Min 2-year workex Expert Revalidation of certification based on credits based on continued workex; recertification exam; industry conference /paper credit (norm to be announced by ESSCI committee)