Chapter 4: JIT, TPM, and ISO Standards

Repeated Questions:

1. JIT and KANBAN:

- **Q.** Discuss the Just in Time (JIT) Concept. / Explain JIT with real field application. / Explain elements/pre-requisites of JIT. **(WINTER 2022, 3 Marks; WINTER 2022, 7 Marks OR; SUMMER 2023, 4 Marks; SUMMER 2025, 4 Marks; WINTER 2025, 3 Marks – "Discuss Just in Time Concept."; SUMMER 2026, 3 Marks – "Explain just in time manufacturing.")**

Answer:

- **Definition:** Just in Time (JIT) is a production philosophy in which required items are produced in the required quantity at the required time — eliminating waste, excess inventory, and delays.

Elements / Pre-requisites:

Stable and level production schedule

Pull system (production triggered by demand)

Small lot sizes and reduced setup times

KANBAN for material flow control

Reliable suppliers and close supplier partnership

Total Productive Maintenance (TPM) for uninterrupted production

Quality at source — no incoming defects

Multifunction workers and flexible workforce

- **Real field application:** In automotive assembly, parts are delivered to the assembly line just before use, reducing inventory and floor space; supermarkets use shelf-level replenishment based on actual sales.
- **Benefits:** Lower inventory, reduced lead time, lower cost, improved quality, and better space utilization.

- **Q.** What is KANBAN? Explain its steps/benefits. / Short note on KANBAN. **(SUMMER 2022, 7 Marks OR; SUMMER 2023, 4 Marks OR; WINTER 2024, 4 Marks; WINTER 2025, 7 Marks – "Explain Quality Production through KANBAN.")**

Answer:

- **Definition:** KANBAN is a visual pull-signal system using cards or signals to authorize production and movement of materials in a JIT environment.

Steps:

Demand signal is generated by downstream consumption.

Withdrawal KANBAN authorizes movement of material from upstream.

Production KANBAN authorizes upstream to produce the required quantity.

Material is replenished only when the card is returned.

Visual control ensures WIP limits and prevents overproduction.

- **Benefits:** Limits work-in-progress, reduces inventory, exposes bottlenecks and defects, simplifies scheduling, and supports continuous improvement.
- **Quality Production through KANBAN:** Prevents overproduction, stops defective items from moving forward, makes problems visible immediately, and enforces disciplined pull-based production.

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2. Total Productive Maintenance (TPM):

- **Q.** Discuss the Pillars of Total Productive Maintenance (TPM). / Define and discuss TPM. **(SUMMER 2022, 7 Marks; SUMMER 2023, 7 Marks; WINTER 2024, 4 Marks OR; SUMMER 2026, 3 Marks – "Explain TPM along with advantages and application.")**

Answer:

- **Definition:** Total Productive Maintenance (TPM) is a maintenance strategy that maximizes equipment effectiveness through preventive and predictive maintenance with total employee participation.

Eight Pillars of TPM:

Autonomous Maintenance — operators maintain their own equipment.

Planned Maintenance — scheduled preventive and predictive maintenance.

Quality Maintenance — maintain equipment to achieve zero defects.

Focused Improvement — kaizen on critical equipment losses.

Education and Training — upgrade operator and maintenance skills.

Safety, Health and Environment — zero accidents and safe workplace.

Office TPM — improve administrative and support functions.

Early Equipment Management — design and install equipment for easy maintenance.

- **Advantages:** Zero breakdowns, zero defects, reduced downtime, lower maintenance cost, higher OEE, and increased equipment life.
- **Application:** Manufacturing plants, automotive lines, process industries, and any equipment-intensive production system.

Diagram Description: A central circle labeled "TPM" surrounded by eight pillars, each labeled with one TPM pillar, resting on a foundation of 5S and total employee involvement.

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3. ISO Standards:

- **Q.** Explain the role/scope/barriers of ISO 14000 in managing environmental practices. **(WINTER 2022, 7 Marks; WINTER 2023, 4 Marks; WINTER 2024, 7 Marks OR; SUMMER 2025, 7 Marks; WINTER 2025, 7 Marks – "Explain basic concepts, scope and implementation barriers of ISO 14000")**

Answer:

- **Basic Concept:** ISO 14000 is a family of international standards for Environmental Management Systems (EMS) that helps organizations manage environmental responsibilities systematically.

Scope:

Environmental policy and planning

Identification of environmental aspects and impacts

Legal and regulatory compliance

Objectives, targets, and environmental programs

Implementation, monitoring, and corrective action

Management review and continual improvement

- **Role:** Reduces environmental impact, ensures compliance, improves resource efficiency, enhances corporate image, and supports sustainable development.

Implementation Barriers:

High cost of certification and training

Lack of top-management commitment

Insufficient employee awareness and training

Difficulty in measuring environmental aspects and impacts

Weak documentation and data management

Resistance to change and bureaucratic procedures

- **Key Standard:** ISO 14001 specifies requirements for an EMS.

- **Q.** Explain Quality Management Standards – ISO 9000. / What is the need of ISO 9000? **(SUMMER 2023, 7 Marks OR; WINTER 2024, 3 Marks OR; SUMMER 2026, 7 Marks – "Write short notes on ISO 9000.")**

Answer:

- **Definition:** ISO 9000 is a family of international standards for Quality Management Systems (QMS) that provides a framework for consistent quality, customer satisfaction, and continual improvement.

ISO 9000 Family:

ISO 9000 — fundamentals and vocabulary

ISO 9001 — requirements for certification

ISO 9004 — guidelines for performance improvement

ISO 19011 — guidelines for auditing

Need for ISO 9000:

Provides international recognition and credibility.

Ensures consistent product/service quality.

Improves customer satisfaction and confidence.

Supports market access and competitive advantage.

Provides a systematic framework for process control.

Enables continual improvement and defect prevention.

- **Key Principles:** Customer focus, leadership, involvement of people, process approach, system approach, continual improvement, factual decision-making, and mutually beneficial supplier relationships.

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4. Six Sigma and Zero Defects:

- **Q.** What is Six Sigma? Briefly explain. **(SUMMER 2022, 4 Marks; SUMMER 2023, 7 Marks OR; WINTER 2024, 7 Marks; SUMMER 2026, 7 Marks – "Explain in details about six sigma process.")**

Answer:

- **Definition:** Six Sigma is a data-driven quality methodology that aims to reduce process variation and defects to 3.4 defects per million opportunities (DPMO).

DMAIC Process:

Define — define the problem, customer requirements, and project goals.

Measure — measure current performance and collect data.

Analyze — identify root causes of variation and defects.

Improve — implement solutions to eliminate root causes.

Control — sustain improvements through monitoring and standard work.

- **Advantages:** Reduced defects, lower cost, higher customer satisfaction, data-based decision-making, and improved process capability.
- **Limitations:** Requires skilled resources and training, high initial cost, not suitable for all processes, and can be time-consuming.

- **Q.** Define Zero defects. Discuss various steps in implementing Zero defects. **(WINTER 2022, 3 Marks OR; SUMMER 2025, 4 Marks OR; WINTER 2025, 7 Marks)**

Answer:

- **Definition:** Zero Defects (ZD) is a quality philosophy introduced by Philip Crosby that aims for no defects by doing the job right the first time and conforming to requirements.

Steps in Implementing Zero Defects:

Management commitment and clear quality policy.

Set quality goals — zero defects as the standard.

Train employees in quality principles and error prevention.

Identify and eliminate causes of defects through root-cause analysis.

Use mistake-proofing (Poka-yoke) to prevent human errors.

Measure and display defect rates for awareness.

Recognize and reward defect-free performance.

Continuously review and improve the process.

Other Important Questions:

1. JIT and Jidoka:

- **Q.** What is JIDOKA? Explain in brief. **(SUMMER 2022, 3 Marks)**

Answer:

- **Definition:** JIDOKA means autonomation — automation with a human touch, where machines stop automatically when an abnormality or defect occurs.
- **Purpose:** Prevents defective items from passing to the next process and prevents equipment damage.
- **Features:** Andon signals, automatic stopping, operator intervention, and built-in quality checks.

- **Q.** Discuss the differences between a traditional push system and a JIT demand-pull system. **(WINTER 2022, 3 Marks OR)**

Answer:

Aspect	Traditional Push System	JIT Demand-Pull System
Production Trigger	Production based on forecast	Production based on actual demand
Inventory	High WIP and finished goods inventory	Low inventory; replenished as consumed
Flow Control	Materials pushed to next stage	Downstream pulls materials using KANBAN
Waste	Overproduction and waiting are common	Overproduction and waiting are minimized

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2. Maintenance Effectiveness and Cost of Quality:

- **Q.** What is Overall Equipment Effectiveness (OEE)? What are the standard benchmarks of OEE? **(SUMMER 2022, 3 Marks OR)**

Answer:

- **Definition:** OEE measures how effectively equipment is utilized by combining Availability × Performance × Quality.
- **Formula:** OEE=Availability×Performance×Quality

- **Standard Benchmarks:** 85% OEE is considered world-class; 60% is typical; 40% is low.
- **Use:** Identifies losses in equipment and guides TPM improvement.

- **Q.** Explain the Cost of Quality in detail. **(WINTER 2022, 4 Marks OR)**

Answer:

Cost Category	Description	Examples
Prevention Cost	Cost of preventing defects	Training, quality planning, supplier evaluation
Appraisal Cost	Cost of measuring and inspecting quality	Inspection, testing, audits
Internal Failure Cost	Cost of defects found before delivery	Scrap, rework, re-inspection
External Failure Cost	Cost of defects found after delivery	Warranty, returns, complaints, recalls

Total Cost of Quality = Prevention + Appraisal + Internal Failure + External Failure.

- **Key Point:** Investing in prevention reduces failure costs and total quality cost.

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3. ISO Standards:

- **Q.** Describe ISO 14000 and QS 9000 with example. **(SUMMER 2026, 4 Marks)**

Answer:

[Answer not found in the answer chat – to be addePd]
