Chapter 5: Contemporary Trends

Repeated Questions:

1. Lean and Agile Manufacturing:

- **Q.** Explain Lean Manufacturing. / What do you mean by Lean manufacturing? Discuss its wastes (Muda) and advantages. **(WINTER 2022, 7 Marks OR; SUMMER 2023, 3 Marks – part a on Muda; WINTER 2024, 4 Marks; WINTER 2025, 3 Marks – "What is Muda? Explain the various types of Muda."; SUMMER 2026, 4 Marks – "Describe about Lean manufacturing.")**

Answer:

Definition:

Lean Manufacturing is a systematic approach to eliminate waste (Muda) and create value for the customer by continuously improving processes, using fewer resources, and delivering exactly what the customer wants, when they want it.

Seven Wastes (Muda):

#	Waste (Muda)	Description
1	Overproduction	Producing more than required or before needed
2	Waiting	Idle time due to delays in material, information, or equipment
3	Transportation	Unnecessary movement of materials between processes
4	Overprocessing	Doing more work than required by the customer
5	Inventory	Excess raw material, WIP, or finished goods
6	Motion	Unnecessary movement of people (walking, reaching)
7	Defects	Producing defective parts requiring rework or scrap

Advantages of Lean Manufacturing:

Reduced waste and lower operating costs.

Lower inventory and reduced lead times.

Improved quality through continuous improvement.

Higher productivity and better space utilization.

Increased customer satisfaction through faster, reliable delivery.

Improved employee morale through involvement and teamwork.

Sustainable operations through waste reduction.

Diagram Description: A diagram of the "Lean Temple" with 5S and stability as the foundation, JIT and Jidoka as pillars, and waste elimination and continuous improvement as the roof.

- **Q.** Explain Agile Manufacturing. **(SUMMER 2022, 4 Marks OR; WINTER 2022, 4 Marks OR; SUMMER 2026, 7 Marks – "Describe Agile manufacturing process.")**

Answer:

Definition:

Agile Manufacturing is a manufacturing strategy that enables an organization to respond rapidly and efficiently to changing customer demands, market conditions, and product requirements through flexibility, reconfigurability, and collaboration.

Key Characteristics:

- **Responsiveness:** Quick response to customer orders and market changes.
- **Flexibility:** Adaptable processes, equipment, and workforce.
- **Reconfigurability:** Ability to reconfigure production systems quickly.
- **Collaboration:** Strong partnerships across the supply chain and virtual enterprises.

- **Information Technology:** Use of IT for real-time communication and decision-making.
- **Customer Focus:** Customized products and services at mass-production cost.

Benefits:

Faster time-to-market.

Ability to handle product variety and small lot sizes.

Improved customer satisfaction.

Reduced inventory and waste.

Competitive advantage in dynamic markets.

- **Application:** Electronics, automotive, aerospace, and custom manufacturing industries.

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2. Benchmarking and World Class Manufacturing:

- **Q.** Explain Benchmarking. / What are the four types of benchmarking? **(WINTER 2022, 3 Marks; SUMMER 2023, 3 Marks OR; WINTER 2023, 7 Marks OR; SUMMER 2025, 3 Marks; WINTER 2025, 3 Marks – "Explain briefly Bench Marking.")**

Answer:

Definition:

Benchmarking is a systematic process of comparing an organization's products, processes, or performance against those of industry leaders or best practices to identify gaps and implement improvements.

Four Types of Benchmarking:

Type	Description	Example
Internal Benchmarking	Comparing within the same organization (departments, units)	Comparing two plants of the same company
Competitive Benchmarking	Comparing with direct competitors	Comparing product quality with a rival firm
Functional Benchmarking	Comparing with best practices in similar functions across industries	Comparing HR practices with a top employer
Generic Benchmarking	Comparing with best practices regardless of industry	Comparing inventory management with Walmart

Steps in Benchmarking:

Identify the process to benchmark.

Select benchmark partners (best-in-class).

Collect and analyze data.

Identify performance gaps.

Implement improvement actions.

Monitor and re-benchmark.

- **Benefits:** Identifies improvement opportunities, sets realistic targets, promotes innovation, and enhances competitiveness.

- **Q.** Explain World Class Manufacturing. **(SUMMER 2022, 7 Marks OR; WINTER 2022, 7 Marks; SUMMER 2026, 3 Marks – "Describe about world class manufacturing.")**

Answer:

Definition:

World Class Manufacturing (WCM) is a collection of best practices and strategies used by leading manufacturers to achieve superior performance in quality, cost, delivery, flexibility, and innovation, benchmarked against global standards.

Key Principles / Pillars:

- **Customer Focus:** Understanding and exceeding customer expectations.
- **Continuous Improvement:** Kaizen, TQM, and lean principles.
- **Total Employee Involvement:** Empowerment, training, and teamwork.
- **Technology and Innovation:** Advanced automation, IT integration, and R&D.
- **Supply Chain Excellence:** Strong supplier partnerships and JIT.
- **Quality Systems:** Six Sigma, ISO 9000, and zero defects.
- **Flexibility and Responsiveness:** Agile and lean manufacturing practices.
- **Performance Measurement:** Benchmarked metrics and data-driven decisions.

Characteristics:

Best-in-class quality and productivity.

Short lead times and reliable delivery.

Low cost and high profitability.

High customer satisfaction and loyalty.

Culture of continuous learning and improvement.

- **Benefits:** Global competitiveness, sustainable growth, and market leadership.

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3. Concurrent Engineering:

- **Q.** Describe the concept of Concurrent Engineering. **(SUMMER 2023, 4 Marks OR; WINTER 2024, 3 Marks; WINTER 2025, 4 Marks)**

Answer:

Definition:

Concurrent Engineering (or simultaneous engineering) is a systematic approach to product development where design, manufacturing, quality, service, and other functions work in parallel from the early stages of design, rather than sequentially.

Key Features:

Cross-functional teams work together.

Design for Manufacture and Assembly (DFMA) considered early.

Parallel processing of product and process design.

Early identification and resolution of design problems.

- **Benefits:** Reduced product development time, lower costs, improved quality, fewer design changes, and higher customer satisfaction.
- **Application:** Automotive, aerospace, electronics, and consumer products.

Other Important Questions:

1. Lean versus Agile:

- **Q.** Differentiate between Lean manufacturing and Agile manufacturing. **(SUMMER 2022, 4 Marks OR)**

Answer:

Aspect	Lean Manufacturing	Agile Manufacturing
Primary Goal	Eliminate waste and reduce cost	Respond quickly to change and variety
Focus	Efficiency and cost reduction	Flexibility and responsiveness
Market Condition	Stable demand, predictable	Volatile demand, unpredictable
Product Variety	Low to moderate variety	High variety, customized products
Inventory Approach	Minimize inventory (JIT)	Buffer capacity and flexible inventory
Supply Chain	Long-term, stable partnerships	Dynamic, virtual collaborations

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2. Business Process Reengineering and Six Sigma:

- **Q.** What is Business Process Reengineering? What are its principles and advantages? **(WINTER 2024, 7 Marks)**

Answer:

Definition:

Business Process Reengineering (BPR) is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical performance measures such as cost, quality, service, and speed.

Principles of BPR:

Organize around outcomes, not tasks — focus on the end result.

Have those who use the output perform the process — empower workers.

Subsume information-processing work into the real work — reduce handoffs.

Treat geographically dispersed resources as centralized — use IT for integration.

Link parallel activities instead of just integrating results.

Put the decision point where the work is performed — control at the source.

Capture information once at the source — eliminate redundant data entry.

Advantages:

Dramatic improvement in process efficiency and effectiveness.

Significant cost reduction.

Improved quality and customer satisfaction.

Faster cycle times and reduced bureaucracy.

Enhanced organizational agility.

- **Risks:** High implementation cost, resistance to change, and risk of failure if not managed properly.

- **Q.** Briefly explain the concept of Six sigma with its advantages and limitations. **(WINTER 2022, 7 Marks OR)**

Answer:

Definition:

Six Sigma is a data-driven, structured quality improvement methodology that aims to reduce process variation and defects to 3.4 defects per million opportunities (DPMO) through the DMAIC (Define–Measure–Analyze–Improve–Control) framework.

Advantages:

Reduced defects and improved product quality.

Lower costs through waste reduction and fewer reworks.

Higher customer satisfaction and loyalty.

Data-based decision-making and process control.

Improved process capability and consistency.

Employee skills development through training and certification.

Limitations:

High initial investment in training and infrastructure.

Time-consuming — projects can take months.

Not suitable for all processes — requires measurable outputs.

Risk of over-reliance on statistics and ignoring qualitative factors.

Resistance from employees due to change and fear of job loss.

Difficulty in sustaining improvements without strong leadership.
