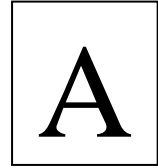




SNS College of Technology, Coimbatore-35.
(Autonomous)
Internal Assessment –I
ANSWER KEY



19AUZ405 – LEAN MANUFACTURING

PART – A

1	List the elements of lean manufacturing? <ul style="list-style-type: none">• Value• mapping the value stream• creating flow• Using a pull system• Pursuing perfection.
2	What do you mean by waste in lean production? <ul style="list-style-type: none">• Any action that does not add value to the customer. Essentially, waste is any unnecessary step in a manufacturing process that does not benefit the customer.
3	List the principle of lean manufacturing? <ul style="list-style-type: none">• Value• Value stream• Flow• Pull• Perfection
4	Recall the benefits of cellular manufacturing. <ul style="list-style-type: none">• Cellular manufacturing helps reduce waste by reducing defects that result from processing and product changeovers.• Products or components move through a cell one piece at a time, operators can quickly identify and address defects.
5	Name the pillars of TPM. <ol style="list-style-type: none">1. Focused Improvement2. Autonomous Maintenance3. Quality Maintenance4. Planned Maintenance5. Early Management6. Training & Education7. Safety, Environment & Health (SHE)8. Administrative TPM
6	(a) Explain the types of lean manufacturing tools. What is 5S? 5S Sort: eliminate that which is not needed Straighten: organize remaining items Shine: clean and inspect work area

Standardize: write standards for above
Sustain: regularly apply the standards

Bottleneck Analysis

- Bottleneck Analysis identifies which part of the manufacturing process limits the overall throughput and improves the performance of that part of the process.
- Bottleneck Analysis improves throughput by strengthening the weakest link in the manufacturing process.

Continuous Flow

- Continuous Flow is manufacturing where work-in-process smoothly flows through production with minimal (or no) buffers between steps of the manufacturing process.
- Continuous Flow eliminates many forms of waste (e.g., inventory, waiting time, and transport).

Just-In-Time (JIT)

- Just-In-Time pulls parts through production based on customer demand instead of pushing parts through production based on projected demand. Relies on many lean tools, such as Continuous Flow, Heijunka, Kanban, Standardized Work, and Takt Time.
- Just-In-Time is highly effective in reducing inventory levels. Improves cash flow and reduces space requirements.

Kaizen (Continuous Improvement)

- Kaizen is a strategy where employees work together proactively to achieve regular, incremental improvements in the manufacturing process.
- Kaizen combines the collective talents of a company to create an engine for continually eliminating waste from manufacturing processes.

Kanban (Pull System)

- Kanban is a method of regulating the flow of goods both within the factory and with outside suppliers and customers. Based on automatic replenishment through signal cards that indicate when more goods are needed.
- Kanban eliminates waste from inventory and overproduction. Can eliminate the need for physical inventories, instead relying on signal cards to indicate when more goods need to be ordered.

KPIs (Key Performance Indicators)

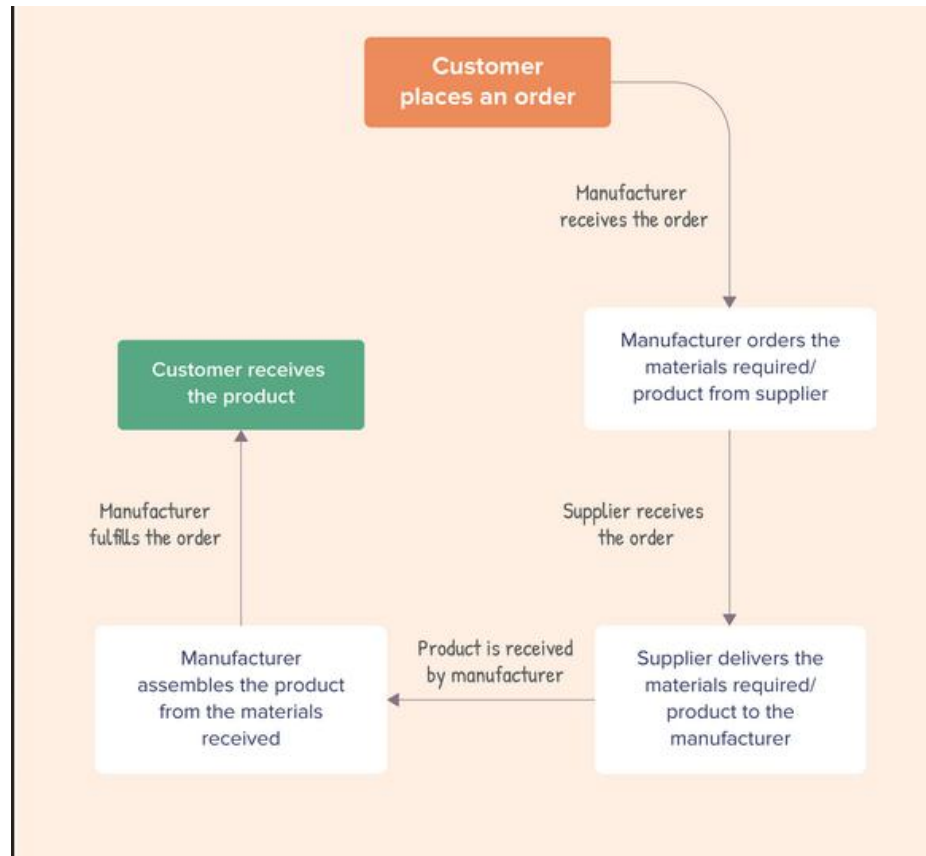
- KPIs are metrics designed to track and encourage progress towards critical goals of the organization. Strongly promoted KPIs can be extremely powerful drivers of behavior – so it is important to carefully select KPIs that will drive desired behavior.

The best manufacturing KPIs:

- Are aligned with top-level strategic goals (thus helping to achieve those goals)
- Are effective at exposing and quantifying waste (OEE is a good example)
- Are readily influenced by plant floor employees (so they can drive results)

	<p>(b) Why do we implement the lean manufacturing? And mention the benefits of implementing lean manufacturing.</p> <ul style="list-style-type: none"> • Lean manufacturing aims to eliminate wastage of resources, minimise product inventory and streamline the production processes for maximum efficiency. This helps manufacturers eliminate waste and reduce costs, allowing them to price their products optimally for the customer while also maximising profits. <p>Benefits of Lean Manufacturing implementation</p> <ul style="list-style-type: none"> • Manage team / process complexity • More efficient business processes • Better management of changing priorities • Better project visibility at the team level • Increased team productivity • Reduced lead time • Increased team morale • Improved visibility to stakeholders • Reduced costs • Predictable delivery of customer value
7	<p>(a) Discover the concept of just-in-time inventory management and its relationship to the lean production concept.</p> <ul style="list-style-type: none"> • Just-in-time, or JIT, is an inventory management method in which goods are received from suppliers only as they are needed. The main objective of this method is to reduce inventory holding costs and increase inventory turnover. <p>Importance of just-in-time</p> <ul style="list-style-type: none"> • Just in time requires carefully planning the entire supply chain and usage of superior software in order to carry out the entire process till delivery, which increases efficiency and eliminates the scope for error as each process is monitored. Here are some of the important effects of a just-in-time inventory management system: <p>Reduces inventory waste</p> <ul style="list-style-type: none"> • A just-in-time strategy eliminates overproduction, which happens when the supply of an item in the market exceeds the demand and leads to an accumulation of unsalable inventories. These unsalable products turn into inventory dead stock, which increases

waste and consumes inventory space. In a just-in-time system you order only what you need, so there's no risk of accumulating unusable inventory.



(b) Demonstrate the implementation of JIT concept with a case study.

- In today's business world, Just in Time (JIT) has been a very popular operation strategy. JIT or lean manufacturing provides a systematic way for minimising the wastage from the manufacturing processes. This system follows certain principles like elimination of waste, delivering products on the right time etc.
- JIT implementation can lead to various benefits such as better product quality, inventory reduction. Though implementation of JIT requires a series of incremental steps to get the essential outcome. As nowadays customers are mostly focused on product quality, delivery time and price of product, successful implementation of JIT is important for many organisations.
- **Toyota Motor Corporation:** Toyota is one of the most well-known examples of companies using the JIT method. When a client places an order, Toyota only receives raw materials in the factory when it is ready to start building the automobile. This process minimizes inventory holding costs.
- Many mass-market retailers use JIT strategies to minimize their inventory costs and provide their customers with large quantities of merchandise at just the right time. For

example, big-box retailers Target Corporation (TGT) and Walmart Inc. (WMT) schedule their seasonal merchandise to arrive just as demand is beginning to pick up for specific items. As the season draws to a close and demand wanes, shelves are cleared to make room for the next season's items.

- Even smaller retailers can take advantage of the JIT method to streamline the delivery process. For example, a company that markets office furniture but does not manufacture it may order the furniture from the manufacturer only when a customer makes a purchase. The manufacturer delivers it directly to the customer. The retailer has saved the cost of storing inventory.

8. (a) Distinguish between conventional manufacturing and lean manufacturing process.

Aspects	Traditional Manufacturing	Lean Manufacturing
No. of equipment and people	High	Less
Factory space for same output	High	Less
Work in Progress (WIP)	High	Less
Defects	High	Less
Operational availability	Less	High
Production Lead time	High	Less
Inventory	Inventory is good	Inventory is WASTE
System schedule	Push system scheduled internally	Pull system scheduled by Customer Requirements
Focus	Focus on Value-Add improvement(5%)	Focus on Non-Value-Add Waste Elimination (95%)
Direct labor cost	High direct labor cost	Direct labor cost is a small percentage of total labor cost
Cycle time	Long cycle time	Short cycle time
Production	Production for inventory (Just In Case-JIC)	Production on demand (Just In Time-JIT)
Inventory level	High inventory levels (Raw, WIP, Finished)	Inventory levels are radically reduced.
Production system	Assembly line flow (Each worker performs one function)	Cell production (Each operator performs multiple operations – multi skilled operators)
Cleanliness	Messy, cluttered and dirty shop floor	Spotless shop floor with visual management

	Quality management	Quality management through inspection and rework	management of quality through prevention
	Changes in production practice	Infrequent changes in production practice	Continuous changes to improve efficiency and productivity
	Management layer	Many layers of management	Fewer layers of management
	structure	Not exactly team based structure	Strong team based structure

(b) What are the types of manufacturing layout in cellular manufacturing and explain them briefly.

I-shaped cell

The I-cell, also known as the linear cell, is an arrangement of machines in a linear order. Being one of the simplest of the cellular layouts, this arrangement is the closest to having multiple assembly lines. It is great for products where the sequence of operations is straightforward, and materials don't need to move back and forth between machines. Additionally, the I-shaped cell can be configured so that technicians can work on both sides of the cell.

U-shaped cell

The U-cell, as the name suggests, is when the machinery is arranged in the shape of the letter U. Although this is similar to the linear cell, the U-shaped cell is more compact and has a smaller footprint on the shop floor. In addition to the space savings, this type of cell layout allows for better communication between technicians since they are much closer to each other than in the I-shaped cell.

O-shaped cell

Also known as the Cage, this is similar to the U-shaped cell but with machines arranged in a rough circle. Usually, these cells are managed by only one technician who is highly skilled at using all the machines in the cage. It is suited for products that require multiple passes through the machines.

T-shaped cell

When products need raw materials from different sources, or when products need to be slightly specialized it is normal to have a T-shaped cell. Cells designed in this pattern can be configured to either have a converging or diverging flow of materials.

S-shaped cell

This layout is used when you want to work around obstructions or irregularities on the shop floor and you still want to implement cellular manufacturing. Although the exact shape of the cell itself doesn't matter so much in this arrangement, the idea is to have a small logical unit of production.