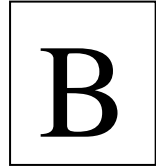




**SNS College of Technology, Coimbatore-35.**  
**(Autonomous)**  
**Internal Assessment -I**  
**19AUZ405 – LEAN MANUFACTURING**  
**ANSWER KEY**  
**PART - A**



1	<p>Define lean manufacturing?</p> <ul style="list-style-type: none"> <li>Lean manufacturing is a methodology that focuses on minimizing waste within manufacturing systems while simultaneously maximizing productivity.</li> </ul>
2	<p>Name the different elements of standardized work.</p> <ul style="list-style-type: none"> <li>Takt time.</li> <li>Work sequence.</li> <li>In-process inventory.</li> </ul>
3	<p>List the principle of lean manufacturing?</p> <ul style="list-style-type: none"> <li>Value</li> <li>Value stream</li> <li>Flow</li> <li>Pull</li> <li>Perfection</li> </ul>
4	<p>Define Kaizen?</p> <ul style="list-style-type: none"> <li>Kaizen is a strategy where employees work together proactively to achieve regular, incremental improvements in the manufacturing process.</li> <li>Kaizen combines the collective talents of a company to create an engine for continually eliminating waste from manufacturing processes.</li> </ul>
5	<p>What is production smoothening?</p> <ul style="list-style-type: none"> <li>Smooth production is a method used in production sectors, mostly in Japan, to reduce production waste of raw materials and resources and drive forward efficiency in terms of manufacturing.</li> </ul>

**PART - B**

6	(a)	<p>Classify the different forms of waste? and explain them briefly.</p> <p><b>Defects</b></p> <ul style="list-style-type: none"> <li>When defects occur, it's necessary to scrap the product and start all over again, thereby creating one of the biggest possible wastes of time, materials and money. In Lean, which has a singular focus on meeting customer needs, a defect means anything that does not satisfy customers.</li> </ul> <p><b>Overproduction</b></p> <ul style="list-style-type: none"> <li>Success can lead businesses to overproduce their products, getting too far ahead of consumer demand. This also applies to processes within the overall</li> </ul>
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operation, such as producing too many parts before workers downstream in the operation are ready to use them. That kind of glut can lead to extra costs to store materials, among other issues.

### **Transportation**

- Problems with transportation typically arise from poorly planned processes. In this context, transportation can mean any part of a process that requires carrying – by hand or vehicle – necessary tools and materials. It can also refer to the time it takes to transmit needed information to continue a process (such as approvals from managers). The longer the transportation route, the larger amount of wasted time.

### **Non-Value Added Processing**

- A variety of issues can lead to actions that do not add value to a process. They include the typical signs of a poorly planned process: poor communication, areas of responsibility that overlap, and data duplication. In Lean, it's vital to assess every step in a process and determine if it adds value to the customer.

### **Motion**

- If a process requires employees to take extra steps – whether physical steps or those taken within a software system – that's a sign of a poorly planned process. Wasted time is wasted money. This problem often traces back to poorly planned work stations as well as work flow.

### **Waiting**

- Waiting can happen in a variety of ways in a production process. In most cases, it involves workers waiting for people upstream to either give them the materials or information they need to proceed with their job. Bottlenecks that develop lead to waiting and wasted time. Other forms of waiting can involve issues such as having to attend numerous meetings rather than getting work done.

### **Inventory**

- Problems with inventory can result from overproduction of materials or finished products that then must get stored. It also can involve ordering too many materials from suppliers and needing large amounts of warehouse space to store them. With inventory, the waste involves the extra money needed to maintain warehouse space that would not get spent with a more streamlined process.

		<p><b>Unused Talent</b></p> <ul style="list-style-type: none"> <li>• This is not related to process issues, but rather a company not leveraging all the employee talent they have at their disposal. For example, frontline workers often have more insight into the true causes of problems than their own managers – as well as ideas on how to address the issue. Unused talent is a challenge at companies in every industry. Eliminating this waste requires managers to make a thorough examination of the skills and knowledge their employees possess and how to put them to use to improve operations.</li> </ul>
	(b)	<p>Discover the concepts of customer focus with an example.</p> <ul style="list-style-type: none"> <li>• Customer Focus is to prioritize your customers and their needs. It's a business philosophy that keeps customers above all your business decisions. You should make all your products or services keeping customer preferences in mind. Customer focus can be called the foundation of making customers loyal towards your brand.</li> <li>• Customer-focused organizations work to cater to customer needs where they concentrate on working for the customers, rather than making money for the company or only thinking of their benefits. Many organizations are losing this battle, as they fail to cater to customer needs and expectations.</li> <li>• Making your company, customer-focused is not the responsibility of only customer support team, but it should be followed by all other departments of your company. Though high skilled customer service team is required for providing effective customer support, delivering a positive experience to them should be the responsibility of the whole organization. It consists of, <ul style="list-style-type: none"> <li>• Good quality products or services</li> <li>• Transparent pricing models</li> <li>• Trustworthy marketing &amp; advertising campaigns</li> <li>• Easy and comfortable sales cycles</li> </ul> </li> </ul> <p>Key points to develop a Customer-Focused Culture</p> <ul style="list-style-type: none"> <li>• Understand Your Customers</li> <li>• Hire the Right Employees</li> <li>• The Whole Company Should Get Exposure to Consumers</li> <li>• Motivate Your Employees</li> <li>• Customer Empathy</li> <li>• Share Customer Feedback with Your Team</li> <li>• Give Opportunities to Learn New Things</li> <li>• Data is Important</li> <li>• Use the Best Customer Service Tool for Providing Better Assistance</li> <li>• Remember Your Customers</li> </ul>
7	(a)	Experiment how the flexible Manufacturing System assist to achieve the values of

	<p>lean production.</p> <ul style="list-style-type: none"> <li>• A flexible manufacturing system (FMS) is a production method that is designed to easily adapt to changes in the type and quantity of the product being manufactured.</li> <li>• A flexible manufacturing system (FMS) can improve efficiency and reduce production costs, which are crucial concerns in the process of business development. Flexible manufacturing also can be a key component of a make-to-order strategy that allows customized products and keeps inventories low. Such flexibility can come with higher up-front costs. Purchasing and installing the specialized equipment that allows for such customization may be costly compared with more traditional systems.</li> <li>• An FMS may be set up in a number of ways. After all, its main lure is its adaptability. One configuration might involve interconnected computer workstations that process the end-to-end creation of a product. This starts with loading/unloading functions and proceeds to machining and assembly, storing, quality testing, and data processing. The FMS programming can automatically switch from one set of products in a certain amount to another set in a different amount.</li> <li>• The main benefit of an FMS is that it makes production more efficient. Delays are reduced, as production doesn't have to be shut down to set up for a different product.</li> <li>• Drawbacks include higher up-front costs and the greater time required to design the system specifications for a variety of future needs. There is also an additional cost for the specialized technicians who work the FMS.</li> </ul>
(b)	<p>What are the three key elements in the JIT approach? Explain them briefly.</p> <p>The three elements are just-in-time manufacturing, total quality management, and respect for people.</p> <p><b>Just-in-Time Manufacturing</b></p> <ul style="list-style-type: none"> <li>• JIT is a philosophy based on elimination of waste. Another way to view JIT is to think of it as a philosophy of value-added manufacturing. By focusing on value-added processes, JIT is able to achieve high-volume production of high-quality, low-cost products while meeting precise customer needs. Just-in-time manufacturing is the element of JIT that focuses directly on the</li> </ul>

production system to make this possible. Many aspects of JIT manufacturing combine to provide a performance advantage.

**Total Quality Management (TQM)**

- The second major element of JIT is total quality management (TQM), which is integrated into all functions and levels of the organization. The foundation of JIT is to produce the exact product that the customer wants. Quality is defined by the customer, and an effort is made by the whole company to meet the customer's expectations.
- Quality is an integral part of the organization; it permeates every activity and function. The benefits of JIT cannot occur if the company is not working toward eliminating scrap and rework. Traditional quality control systems use the concept of acceptable quality level (AQL) to indicate the acceptable number of defective parts. In JIT there is no such measure—no level of defects other than zero is acceptable.

**Respect for People**

- The third element of JIT is respect for people. Often, the study of JIT focuses exclusively on JIT manufacturing. However, the involvement of workers is central to the JIT philosophy. None of the improvements developed by JIT could be possible without respect for people. JIT requires total organizational reform and participation by everyone in the company. Everyone is equally important and equally involved. In a JIT system all functions of the company must work together to meet customer needs. Managers are not isolated in an administrative wing but spend time on the production floor.
- JIT considers people to be a company's most precious resource. The JIT philosophy believes in treating all employees with respect, providing job security, and offering significant rewards for well-performed tasks. Respect for people extends to suppliers. JIT believes in developing long-term relationships with suppliers in a partnership format.

8.	(a)	<p>Demonstrate the different lean manufacturing tools in detail.</p> <p><b>5S</b>  Sort: eliminate that which is not needed  Straighten: organize remaining items  Shine: clean and inspect work area  Standardize: write standards for above</p>
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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)

	<ul style="list-style-type: none"> <li>• Are readily influenced by plant floor employees (so they can drive results)</li> </ul>
(b)	<p>Explain in detail about the various pillars of TPM.</p> <p><b>Focused Improvement</b></p> <ul style="list-style-type: none"> <li>• Focused improvement is the first pillar of TPM. The priorities are clear: improve, improve, and improve continuously. To avoid the loss of equipment, talent, raw materials, and energy, the whole team must share this vision. The team must be proactive, willing to try new methods, and eager to sit around the table to work out problems.</li> </ul> <p><b>Autonomy</b></p> <ul style="list-style-type: none"> <li>• Autonomy is the second pillar of TPM, in the sense that every team is an autonomous “maintenance agent”. Everyone has the autonomy to clean, inspect, and contribute to the upkeep of the assets they work with. This ensures every piece of equipment is cared for, improves early fault detection, and frees maintenance technicians for heavier tasks. Learn more about autonomous maintenance and how to implement it.</li> </ul> <p><b>Quality Maintenance</b></p> <ul style="list-style-type: none"> <li>• One of TPM’s biggest goals is manufacturing zero defective products, which, undoubtedly, also plays into customer satisfaction. Hence, quality management and implementing internal processes linked to quality control are another pillar. We recommend several root cause analysis tools to root out problems.</li> </ul> <p><b>Planned Maintenance</b></p> <ul style="list-style-type: none"> <li>• Planned maintenance – whether it is planned reactive maintenance or preventive maintenance – is the best way to avoid downtime and breakdowns. Keep every asset up and running to ensure quality and avoid customer complaints (for B2C), and improved compliance (for B2B service providers)</li> </ul> <p><b>Early Equipment Maintenance</b></p> <ul style="list-style-type: none"> <li>• Early equipment maintenance is one of the 8 pillars of a well-succeeded TPM strategy. When it’s time to choose new equipment or develop new products, consider previous experiences to make maintenance easier. This can be as simple as choosing a washable paint for the walls (which makes cleaning easier), or as complex as picking a robot which can self-diagnose malfunctions (which improves production).</li> </ul> <p><b>Training and Education</b></p> <ul style="list-style-type: none"> <li>• TPM requires investing in training and education. Otherwise, it’s impossible to trust each worker with routine maintenance or prevention. For TPM to work, basic maintenance knowledge about assets used daily is non-negotiable. Besides, when you think about how fast technology evolves, continuous training is the only way to make sure your technicians are</li> </ul>

familiar with new equipment and the state-of-the-art of the industry.

**Safety, Health and Environment**

- TPM also aims at zero work accidents, zero pollution, and zero burnout. Good maintenance management not only avoids accidents during maintenance activities but also contributes to every worker's well-being and safety.

**Office TPM**

- The last of the 8 pillars is office TPM. This means administrative workers and managers should also chip in, instead of leaving it to the "worker bees". Everyone, without exception, must be proactive and focused on improvements, from logistics to scheduling.