JEPPIAAR
ENGINEERING COLLEGE

DEPARTMENT OF MANAGEMENT STUDIES

MBA / CF / 2025-27/ MB25C11

COURSE FILE – THEORY

SUBJECT	:	**OPERATION MANAGEMENT**
SUBJECT CODE	:	**MB25C11**
BRANCH	:	**MBA**
SEMESTER	:	**II**
YEAR	:	**I**

JEPPIAAR
ENGINEERING COLLEGE

DEPARTMENT OF MANAGEMENT STUDIES

DETAILED SYLLABUS

BA4204 OPERATIONS MANAGEMENT L T P C
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COURSE OBJECTIVE:

This course provides a holistic understanding of operations management as a vital function in achieving strategic and operational excellence in organizations. It covers tools, techniques, and strategies to design, plan, control, and improve manufacturing and service operations. Emphasis is placed on capacity planning, product design, supply chain strategies, quality management, and lean operations. Students will explore recent trends including digital operations, sustainable practices, anddata-driven decision-making to gain competitive advantage in the global market.

UNIT I OVERVIEW OF OPERATIONS MANAGEMENT AND STRATEGIC ALIGNMENT

Operations Management — Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends. Operations Strategy – Strategic fit , framework. Productivity; World-class manufacturing practices

UNIT II CAPACITY, FACILITY AND SUPPLY CHAIN DECISIONS

Capacity Planning — Long range, Types, Developing capacity alternatives, tools for capacity planning. Facility Location – Theories, Steps in Selection, Location Models. Sourcing and procurement - Strategic sourcing, make or buy decision, procurement process, managing vendors.

UNIT III PROCESS, PRODUCT AND LAYOUT DESIGN

Product Design - Criteria, Approaches. Product development process - stage-gate approach - tools for efficient development. Process - design, strategy, types, analysis. Facility Layout — Principles, Types, Planning tools and techniques.

UNIT IV FORECASTING, RESOURCE AND INVENTORY PLANNING

Demand Forecasting — Need, Types, Objectives and Steps - Overview of Qualitative and Quantitative methods. Operations planning - Resource planning - Inventory Planning and Control. Operations Scheduling - Theory of constraints - bottlenecks, capacity constrained resources, synchronous manufacturing

UNIT V QUALITY MANAGEMENT AND LEAN THINKING

Definitions of quality, The Quality revolution, quality gurus; TQM philosophies; Quality management tools, certification and awards. Lean Management - philosophy, elements of JIT manufacturing, continuous improvement. Six sigma.

UNIT V EMERGING TRENDS IN OPERATION MANAGEMENT

Digital transformation in operations –Industry 4.0 and smart factories –Sustainable operations and green manufacturing –Service operations and scalability –Operations analytics –Blockchain in supply chains –Resilience and risk mitigation –Global operations strategy –Case studies on Indian and global practices.

REFERENCE

1. Richard B. Chase, Ravi Shankar, F. Robert Jacobs, Operations and Supply Chain Management, McGraw Hill, 17th Ed., 2023

2. B. Mahadevan, Operations Management: Theory and Practice, Pearson, 4th Ed., 2018

3. William J. Stevenson, Operations Management, McGraw Hill, 14th Ed., 2022

4. Cecil C. Bozarth & Robert B. Handfield, Introduction to Operations and Supply Chain Management, Pearson, 5th Ed., 2023

5. Norman Gaither & Gregory Frazier, Operations Management, Cengage, 11th Ed., 2022

6. R. Paneerselvam, Production and Operations Management, PHI Learning, 3rd Ed., 2017

7. Nigel Slack, Operations Management, Pearson, 10th Ed., 2023

8. S. Chopra & P. Meindl, Supply Chain Management: Strategy, Planning, and Operation, Pearson, 8th Ed., 2024

9. Russel & Taylor, Operations Management, Wiley, 11th Ed., 2022

E-Resources:

- ✧ MIT OpenCourseWare –Operations Management
- ✧ Coursera –Operations Management by Wharton
- ✧ LinkedIn Learning –Operations Strategy
- ✧ ASQ –American Society for Quality
- ✧ Harvard BusinessReview –Operations Insights

Internal Assessment (Total: 100 Marks)Component	**Weightage**
Written Test I & II	60%
Assignment, Presentation, Case Study, Quiz, Simulation, Online Certification, Seminar, Mini project	40%

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DEPARTMENT OF MANAGEMENT STUDIES

CO-PO MATRIX

CO–PO–PSO Mapping Matrix: :

CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2
CO1	3	2	3	3	2	2	2
CO2	3	3	3	2	3	3	2
CO3	3	2	3	3	3	2	3
CO4	3	3	3	2	3	3	3
CO5	3	3	3	3	2	3	2

JEPPIAAR

ENGINEERING COLLEGE

DEPARTMENT OF MANAGEMENT STUDIES

I YEAR / II SEMESTER

BA4204: OPERATIONS MANAGEMENT

LECTURE NOTES– NOTES

Faculty In charge

MS. HARITHA HARI K

Anna University Chennai

Regulation 2025

UNIT I

INTRODUCTION

SYLLABUS

Operations Management — Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends. Operations Strategy – Strategic fit, framework. Productivity; World-class manufacturing practices

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LECTURE 1	CO1	PO1,PO2

INTRODUCTION:

OPERATIONS MANAGEMENT

- Operations Management (OM) refers to the administration of business practices to create the highest level of efficiency within an organization.
- It focuses on converting raw materials and labour into goods and services in the most efficient manner while maintaining quality and customer satisfaction.
- Key components
    - **Strategy**: Analysing data and information to determine how to reach objectives
    - **Quality control**: Ensuring that products and services meet quality standards
    - **Supply chain management**: Monitoring processes, production, sales, and distribution
    - **Inventory management**: Tracking the movements of raw materials, shipping, and finished goods
    - **Human resource management**: Managing, training, and assessing employees

Definition of Operations Management

According to Stevenson "Operations management involves the planning, organizing, coordinating, and controlling of resources needed to produce goods and services."

According to Chase, Aquilano, and Jacobs "Operations management is the set of activities that creates value in the form of goods and services by transforming inputs into outputs."

Nature of Operations Management

Operations Management has the following key characteristics:

1. **Transformational Process:** Converts inputs (raw materials, labor, capital) into outputs (finished goods/services).
2. **Interdisciplinary Approach:** Involves elements of finance, marketing, human resources, and engineering.
3. **Continuous Improvement:** Focuses on quality enhancement and process efficiency (e.g., Lean Management, Six Sigma).
4. **Customer-Oriented:** Aims at maximizing customer satisfaction through efficient production and service delivery.
5. **Decision-Making Function:** Involves strategic, tactical, and operational decision-making in production, logistics, and supply chain management.
6. **Technology Integration:** Utilizes automation, AI, and data analytics to optimize operations.

Importance of Operations Management

1. **Enhances Productivity:** Efficient use of resources leads to higher productivity and profitability.
2. **Improves Quality:** Ensures high-quality standards through Total Quality Management (TQM) and Six Sigma.
3. **Cost Reduction:** Minimizes wastage, optimizes supply chain, and reduces operational costs.
4. **Ensures Customer Satisfaction:** Timely production and delivery of quality goods/services improve customer experience.
5. **Supports Strategic Goals:** Aligns operational activities with the overall business strategy.
6. **Encourages Innovation:** Facilitates process and product innovation to gain a competitive edge.
7. **Sustainability & Compliance:** Helps in adhering to environmental and legal regulations.

Need for Operations Management

1. **Efficient Resource Utilization:** Optimizing materials, manpower, and machinery for maximum output.
2. **Competitive Advantage:** Streamlining operations helps businesses stay ahead of competitors.
3. **Meeting Market Demand:** Ensuring a balance between supply and demand through proper planning.
4. **Cost Control & Profitability:** Helps in reducing costs while maintaining profitability.
5. **Risk Management:** Identifies potential risks in production and supply chain and mitigates them.
6. **Scalability & Growth:** Supports business expansion by improving operational capabilities.

LECTURE 2	CO1	PO1, PO2

Historical Development of Operations Management

Operations Management has evolved over centuries, adapting to technological advancements and changing business needs. The key historical phases are:

1. Pre-Industrial Era (Before 18th Century)

- Operations were mostly **craft-based**, with artisans producing goods using simple tools.
- Production was slow, customized, and local.
- Examples: Blacksmiths, potters, and weavers creating handmade products.

2. Industrial Revolution (18th – 19th Century)

- **Mass production** emerged with mechanization.
- Introduction of **factories** and **steam engines** increased efficiency.
- **Division of labour** (Adam Smith's concept) led to specialization.
- Key figures:
    - **James Watt (1760s)** – Steam engine revolutionized manufacturing.
    - **Eli Whitney (1790s)** – Interchangeable parts improved production.

3. Scientific Management Era (Early 20th Century)

- **Frederick Winslow Taylor (1911)** introduced *Scientific Management* to improve labour efficiency.
- Focus on **standardization, time and motion studies**, and worker productivity.
- **Henry Ford (1913)** pioneered the **assembly line** for mass production of automobiles.
- **Frank and Lillian Gilbreth** – Studied motion efficiency to reduce waste in work processes.

4. Human Relations and Quality Movement (1930s – 1950s)

- **Elton Mayo (Hawthorne Studies)** emphasized the role of human behaviour in productivity.
- **Total Quality Management (TQM)** emerged, focusing on continuous improvement.
- **Edward Deming and Joseph Juran** introduced quality control methods, especially in Japan.

5. Computer and Automation Era (1950s – 1970s)

- **Operations Research (OR)** developed, applying mathematical models to decision-making.
- Introduction of **MRP (Material Requirements Planning)** systems to improve inventory management.

- **Robotics and automation** began replacing manual labour in manufacturing.

6. Globalization and Lean Production (1980s – 2000s)

- **Toyota Production System (TPS)** introduced **Lean Manufacturing** to eliminate waste.
- **Six Sigma (1986, Motorola)** focused on reducing process defects.
- **Supply Chain Management (SCM)** became essential for global operations.

7. Digital and AI-driven Operations (2000s – Present)

- **Internet of Things (IoT), Artificial Intelligence (AI), and Block chain** are transforming operations.
- **Big Data Analytics** helps in predictive decision-making.
- **Sustainable Operations** focus on eco-friendly production and CSR initiatives.
- Rise of **Industry 4.0,** integrating cyber-physical systems into operations.

Transformation Processes in Operations Management

Transformation processes refer to how inputs (resources) are converted into outputs (goods/services).

Types of Transformation Processes

1. **Physical Transformation**
    - Involves changing raw materials into finished goods.
    - Example: Manufacturing (converting steel into cars).
2. **Informational Transformation**
    - Processing data to create valuable insights.
    - Example: Banks processing customer transactions.
3. **Locational Transformation**
    - Moving goods or people from one place to another.
    - Example: Logistics and transportation companies.
4. **Exchange Transformation**
    - Trading goods/services for money.
    - Example: Retail stores, e-commerce platforms.
5. **Storage Transformation**
    - Holding products until needed.
    - Example: Warehousing and inventory management.
6. **Physiological Transformation**
    - Changing a person's physical state.
    - Example: Healthcare, fitness training.
7. **Psychological Transformation**
    - Changing emotions or experiences.
    - Example: Ent ertainment, education, counseling services.

Operations Management ensures that these transformation processes are efficient, cost-effective, and aligned with customer needs.

LECTURE 3	CO1	PO1, PO2,PO4

Differences Between Services and Goods

Operations Management deals with both **goods** (tangible products) and **services** (intangible offerings). However, there are significant differences between the two:

Aspect	Goods (Manufacturing)	Services (Service Operations)
Tangibility	Tangible (physical products)	Intangible (cannot be touched)
Production Process	Goods are **produced first** and then sold.	Services are **consumed as they are produced.**
Customer Involvement	Less involvement; customers receive finished goods.	High involvement; customers are part of the service process.
Storability	Can be stored in inventory for future sales.	Cannot be stored; must be consumed immediately.
Standardization	Can be mass-produced with uniform quality.	Often customized to meet individual customer needs.
Quality Measurement	Quality is measured using physical attributes (e.g., durability, size).	Quality is subjective and based on customer satisfaction.
Automation & Technology	Highly automated; machines play a major role.	Requires human interaction and expertise.
Example	Cars, furniture, smartphones.	Banking, education, healthcare.

Operations Management as a System Perspective

Understanding the System Perspective in OM

A **system perspective** in Operations Management views a business as a **set of interconnected processes** working together to achieve objectives. This approach ensures that all components—**inputs, processes, and outputs**—are aligned for efficiency and effectiveness.

Components of the System in Operations Management

1. **Inputs (Resources Used)**
   - Raw materials
   - Labour (employees)
   - Machinery & technology

- Information
- Capital

2. **Transformation Process (Conversion of Inputs to Outputs)**
   - Manufacturing (for goods)
   - Service delivery (for services)
   - Process improvement (Lean, Six Sigma)
3. **Outputs (Final Product or Service)**
   - Finished goods (cars, electronics, food products)
   - Services (banking, education, healthcare)
4. **Feedback Mechanism**
   - Customer feedback
   - Quality control & continuous improvement
   - Market analysis & adaptation

Types of Systems in Operations Management

System Type	Description	Example
Open System	Interacts with the external environment (customers, suppliers, government).	Manufacturing companies, retail stores.
Closed System	Operates independently with minimal external influence.	Highly automated factories, research labs.
Dynamic System	Continuously adapts to market changes.	E-commerce platforms, online services.

Importance of the System Perspective in OM

- **Improves Efficiency** – Ensures smooth workflow and resource optimization.
- **Enhances Coordination** – Aligns different departments (HR, finance, production, marketing).
- **Facilitates Decision-Making** – Uses data-driven insights for better planning.
- **Ensures Customer Satisfaction** – Focuses on delivering value to customers.

Example: Applying the System Perspective in a Fast-Food Chain

1. **Inputs** – Ingredients, staff, kitchen equipment, order management system.
2. **Transformation Process** – Cooking, packaging, and serving food.
3. **Outputs** – Delivered meals (goods) and customer service experience.
4. **Feedback** – Customer reviews, sales data, quality checks to improve service.

LECTURE 4	CO1	PO1, PO2

Factors Affecting Operations Management

Operations Management is influenced by various **internal and external factors** that impact efficiency, productivity, and overall business success. These factors determine how effectively an organization can produce goods and deliver services.

1. Internal Factors Affecting Operations Management

These factors are **within the control** of the organization and can be managed through strategic planning.

Factor	Description	Example
1. Human Resources	Skilled and motivated employees improve productivity. Poor labour management leads to inefficiencies.	Hiring trained staff, employee training programs.
2. Technology & Automation	Advanced technology enhances production efficiency and service delivery.	Robotics in manufacturing, AI in customer service.
3. Production & Process Design	Efficient production layouts reduce waste and improve workflow.	Lean Manufacturing, Six Sigma.
4. Inventory & Supply Chain Management	Effective inventory control ensures smooth operations and avoids shortages or excess stock.	Just-In-Time (JIT) inventory system.
5. Quality Control & Standards	Maintaining high quality ensures customer satisfaction and reduces defects.	ISO certification, Total Quality Management (TQM).
6. Financial Resources	Budget constraints impact investment in operations, technology, and workforce.	Availability of capital for new machinery or expansion.
7. Organizational Structure & Leadership	Clear decision-making, leadership style, and company policies affect operational efficiency.	Centralized vs. decentralized decision-making.

2. External Factors Affecting Operations Management

These factors come from **outside the organization** and must be adapted to remain competitive.

Factor	Description	Example
1. Market Demand & Customer Expectations	Businesses must align operations with changing consumer needs and preferences.	Customization of products, faster delivery.
2. Economic Conditions	Inflation, interest rates, and economic downturns affect operational costs and consumer purchasing power.	Recession leads to cost-cutting measures.
3. Government Regulations & Legal Environment	Compliance with labor laws, environmental regulations, and safety standards is mandatory.	GST, tax laws, pollution control laws.

Factor	Description	Example
4. Competition & Industry Trends	Competitor strategies force companies to innovate and improve efficiency.	Introduction of automation to reduce costs.
5. Globalization & Supply Chain Complexity	International markets create new opportunities and challenges in sourcing materials and logistics.	Import-export regulations, global suppliers.
6. Technological Advancements	Rapid changes in technology require continuous adaptation in operations.	Use of cloud computing in business operations.
7. Environmental & Sustainability Concerns	Companies must adopt sustainable practices to minimize environmental impact.	Renewable energy, eco-friendly packaging.
8. Social & Cultural Factors	Consumer preferences based on social trends and cultural differences affect product design and marketing.	Vegan food trends, ethical sourcing.
9. Political & Geopolitical Issues	Trade policies, tariffs, and geopolitical tensions affect supply chains and production.	Brexit impacting European trade.
10. Infrastructure & Logistics	Efficient transportation and distribution networks ensure smooth operations.	Poor road conditions delaying deliveries.

LECTURE 5	CO1	PO1, PO2,PO6

Functions of Operations Management

Operations Management involves various functions that help organizations achieve their business objectives:

a. Planning & Forecasting

- Demand forecasting for production planning
- Capacity planning to optimize resources
- Inventory management and procurement
- Example: Demand forecasting for seasonal products.

b. Product & Process Design

- Designing efficient production processes
- Developing new products and services
- Ensuring quality control and compliance
- Example: Designing a new smartphone or banking service

c. **Logistics & Distribution Management**

- Transportation and distribution of goods
- Ensuring timely delivery of goods/services to customers.
- Example: Optimizing delivery routes for e-commerce companies.

d. Quality Management

- Implementing Total Quality Management (TQM)
- Using Six Sigma and Lean methodologies
- Ensuring customer satisfaction
- Example: Six Sigma techniques to reduce defects.

e. Productivity & Efficiency Improvement

- Resource optimization (manpower, machines, materials)
- Implementing automation and technology
- Reducing waste and operational costs

f. Sustainability & Risk Management

- Environmental sustainability initiatives
- Ensuring workplace safety
- Managing operational risks and disruptions
- Example: Using renewable energy in manufacturing plants.

g. Workforce & Human Resource Management

- Hiring, training, and managing employees for productivity.
- Example: Employee training programs for factory workers.

h. Customer Service & Relationship Management

- Handling customer complaints and improving service delivery.
- Example: AI chatbots for customer support.

i. Supply Chain & Inventory Management

- Managing suppliers, procurement, and inventory levels.
- Example: Just-In-Time (JIT) inventory system.

Challenges in Operations Management

Despite technological advancements, businesses face several challenges in operations management:

1. Supply Chain Disruptions

- Global supply chain dependencies and disruptions (e.g., COVID-19, geopolitical tensions)
- Shortage of raw materials and transportation delays
- Example: COVID-19 impacting semiconductor production.

2. Technological Integration

- Adopting automation, AI, and IoT in operations
- Managing cybersecurity risks in digital transformation
- Example: Implementing AI-driven predictive maintenance.

3. Cost Control & Efficiency

- Balancing cost-cutting with quality and efficiency
- Managing rising labour and energy costs
- Example: Managing inflation in supply chain costs.

4. Workforce Management

- Shortage of skilled labour in certain industries
- Employee retention and job satisfaction
- Example: High attrition in IT and manufacturing industries.

5. Sustainability & **Environmental Concerns**

- Implementing eco-friendly and sustainable practices
- Pressure to reduce carbon footprint and implement green practices.
- Example: Switching to biodegradable packaging.

6. Customer Expectations & Customization

- Growing demand for personalized products and services
- Faster delivery expectations (e.g., same-day delivery models)

7. Quality & Compliance Regulations

- Stricter quality and safety laws requiring operational adjustments.
- Example: Adhering to ISO 9001 quality standards.

8. Cybersecurity Threats

- Protecting operational data from cyberattacks.
- Example: Implementing block chain in supply chain management.

9. Competitive Market Pressure

- Staying ahead of competitors by improving efficiency and innovation.
- Example: Amazon's fast delivery challenging local retailers.

Current Priorities in Operations Management

Operations managers today focus on the following key priorities to stay competitive and efficient:

a. Digital Transformation & Automation

- Adopting AI, robotics, and IoT in manufacturing and service industries
- Implementing predictive analytics for demand forecasting
- Example: AI-based inventory forecasting.

b. Resilient & Agile Supply Chains

- Diversifying supplier base to reduce risks
- Implementing just-in-time (JIT) and lean inventory management
- Example: Using multiple suppliers instead of a single source.

c. Sustainability & Green Operations

- Reducing carbon footprint and waste
- Implementing circular economy practices (recycling and reusing materials)
- Example: Implementing circular economy models in manufacturing.

d. Customer-Centric Operations

- Personalizing products and services based on customer data
- Enhancing after-sales support and service
- Example: Personalized product recommendations using AI.

e. Workforce Development & Hybrid Work Models

- Training employees for digital tools and automation
- Implementing remote work models where possible

f. Risk Management & **Cybersecurity**

- **Strengthening cybersecurity measures**
- **Protecting operational systems from cyber threats.**
- Implementing block chain for secure transactions.

LECTURE 6	CO1	PO1, PO2

Recent Trends in Operations Management (OM)

Operations Management is evolving rapidly due to **technological advancements, market demands, and sustainability concerns.** Here are the **latest trends** shaping OM in 2024:

1. Digital Transformation & Industry 4.0

Key Developments:

- **AI & Machine Learning (ML):** Predictive analytics for demand forecasting and process optimization.
- **Internet of Things (IoT):** Smart sensors in factories for real-time monitoring.
- **Robotic Process Automation (RPA):** Automating repetitive tasks like order processing.
- **Digital Twins:** Creating virtual models of production lines for testing improvements.

Example: Tesla uses AI-powered **smart factories** for real-time adjustments in manufacturing.

2. Smart & Resilient Supply Chains

Key Developments:

- **Block chain for Transparency:** Secure, tamper-proof records of transactions.
- **Supply Chain Resilience:** Diversifying suppliers to reduce risks from geopolitical issues.
- **Drones & Autonomous Vehicles:** Faster, contactless delivery options.

Example: Walmart uses **block chain** to track food safety across its supply chain.

3. Sustainability & Green Operations

Key Developments:

- **Circular Economy Models:** Recycling and reusing materials to reduce waste.
- **Carbon Neutral Operations:** Using renewable energy in factories.

- **Eco-Friendly Packaging:** Reducing plastic use in logistics.

Example: Unilever is working towards **net-zero emissions** in its operations.

4. Hyper automation in Manufacturing

Key Developments:

- **AI-powered Quality Control:** Detecting defects with computer vision.
- **Self-Learning Machines:** Adaptive systems that improve efficiency over time.
- **3D Printing & Additive Manufacturing:** Custom manufacturing at lower costs.

Example: Boeing uses **3D printing** to create lightweight aircraft parts.

5. Omni-channel & E-Commerce Integration

Key Developments:

- **Seamless Online-Offline Experience:** Retailers integrating physical and digital stores.
- **Automated Warehouses:** AI-powered inventory management for faster deliveries.
- **Direct-to-Consumer (DTC) Models:** Brands selling directly without intermediaries.

Example: Amazon's **automated fulfilment center's** process orders within minutes.

6. Data-Driven Decision Making & Predictive Analytics

Key Developments:

- **Big Data Analytics:** Using data insights for operational efficiency.
- **Predictive Maintenance:** AI detecting machine failures before they occur.
- **Demand Forecasting:** AI optimizing inventory levels.

Example: Coca-Cola uses **AI-based demand forecasting** to optimize production.

7. Human-Machine Collaboration & Workforce 4.0

Key Developments:

- **Cobots (Collaborative Robots):** Working alongside humans in manufacturing.
- **Upskilling Workforce:** Training employees for digital operations.
- **AI-Powered HR Management:** Automated scheduling and performance tracking.

Example: BMW uses **cobots** in assembly lines to assist workers.

8. Agile & Lean Operations

Key Developments:

- **Just-in-Time (JIT) 2.0:** AI-based lean manufacturing with real-time monitoring.
- **Flexible Production Models:** Rapid response to market changes.
- **Digital Kanban Systems:** Automating workflow management.

Example: Toyota's **Lean Manufacturing 4.0** optimizes production efficiency.

9. Cybersecurity & Risk Management in OM

Key Developments:

- **Zero Trust Security Models:** Strict access controls for data protection.
- **Cyber Threat Detection:** AI monitoring for security breaches.
- **Cloud-Based Operations:** Secure storage for operational data.

Example: Siemens uses **AI-driven cybersecurity** in industrial automation.

10. Ethical & Socially Responsible Operations

Key Developments:

- **Fair Trade & Ethical Sourcing:** Ensuring responsible procurement practices.

- **Diversity & Inclusion in Workforce:** Promoting equal opportunities.
- **Transparent ESG (Environmental, Social, Governance) Reporting:** Companies being accountable for sustainable practices.

Example: Apple ensures **100% ethical sourcing** of rare minerals for its products.

LECTURE 7	CO1	PO1, PO2,PO6

Operations Strategy

Operations Strategy refers to the **long-term plan** that guides how a company's **operations function** supports its overall **business strategy.** It involves making key decisions about **processes, resources, technology, and supply chain management** to ensure efficiency and competitiveness.

Objectives of Operations Strategy

- Cost Efficiency
- Improve product/service quality
- Enhance customer satisfaction
- Ensure flexibility & adaptability
- Optimize supply chain and logistics

Example: Amazon's operations strategy focuses on **automation, AI-driven logistics, and rapid delivery** to maintain a competitive edge.

Elements of Operations Strategy

Operations Strategy consists of several key elements that determine how a company manages its resources and processes.

1. Competitive Priorities

Companies develop operations strategies based on the following priorities:

- **Cost Leadership:** Reducing costs to offer the lowest prices. *(Example: Walmart – "Everyday Low Prices")*
- **Quality:** Delivering high-quality products/services. *(Example: Apple – Premium smartphones & laptops)*
- **Speed:** Fast production and delivery times. *(Example: Domino's – "30 minutes or free")*
- **Flexibility:** Customization and ability to adapt to demand changes. *(Example: Nike – Personalized shoes through Nike By You)*

2. Process & Technology Decisions

- Choosing between **manual vs. automated** production.
- Implementing **Lean Manufacturing** for efficiency.

- Using **AI and robotics** to improve productivity.

3. Capacity Planning

- Ensuring **production facilities** can meet demand.
- Deciding on **expansion strategies** (new factories, outsourcing, etc.).

4. Supply Chain & Logistics

- Managing supplier relationships for **cost, speed, and reliability**.
- Optimizing **warehousing, transportation, and inventory levels.**

5. Sustainability & Corporate Social Responsibility (CSR)

- Implementing **eco-friendly production** and reducing waste.
- Ensuring **ethical sourcing** of raw materials.

Example: Tesla's **Gigafactories** use renewable energy for sustainable production.

Strategic Fit in Operations Strategy

What is Strategic Fit?

Strategic fit means aligning **operations strategy** with **business strategy** to achieve competitive advantage.

If a company follows a **low-cost strategy**, its operations must focus on **efficiency, automation, and lean processes**.If a company follows a **differentiation strategy**, its operations must focus on **innovation, quality, and flexibility.**

Examples of Strategic Fit

Business Strategy	Operations Strategy	Example
Cost Leadership (Low-cost products)	High efficiency, Lean operations, Bulk purchasing	Walmart
Differentiation (Unique, high-quality products)	Innovation, R&D, Customization	Apple
Speed (Time-based competition)	Just-in-Time (JIT), Agile operations	Amazon
Flexibility (Customization)	Modular production, Demand-driven supply chain	Nike

Example: Zara's **fast fashion model** aligns with its operations strategy by using **quick-response manufacturing and real-time inventory updates** to stay ahead of trends.

LECTURE 7	CO1	PO1, PO2,PO4

Framework of Operations Strategy

Operations Strategy provides a long-term plan that guides how an organization's operations function contributes to its overall business strategy. It aligns production and service processes with competitive priorities to achieve business goals.

Key Elements of Operations Strategy Framework

A strong operations strategy includes several key components:

a. Competitive Priorities

- **Cost** – Minimizing costs to offer competitive pricing
- **Quality** – Ensuring product/service excellence
- **Flexibility** – Adapting to market changes and customer demands
- **Delivery Speed & Reliability** – Meeting customer expectations for timely delivery
- **Innovation** – Implementing new processes, products, and services

b. Decision Areas in Operations Strategy

- **Process Design** – Choosing production methods (e.g., job shop, batch, continuous flow)
- **Capacity Planning** – Deciding facility size and resource allocation
- **Supply Chain & Logistics** – Managing supplier relationships and distribution
- **Technology Adoption** – Implementing automation, AI, and digital tools
- **Workforce Management** – Hiring, training, and retaining employees
- **Sustainability & Risk Management** – Ensuring environmental and social responsibility

c. Alignment with Corporate Strategy

Operations strategy must align with overall business goals to support competitive advantage:

- **Cost Leadership Strategy** → Focus on efficiency, lean operations, and automation
- **Differentiation Strategy** → Focus on innovation, customization, and quality
- **Focus/Niche Strategy** → Specialization in a particular market or product segment

Issues in Operations Management

Despite advancements in operations management, businesses face several key challenges:

1. Supply Chain Disruptions

- Global events (e.g., COVID-19, wars, trade restrictions)
- Shortages of raw materials and rising transportation costs
- Dependence on a limited number of suppliers

2. Cost & Efficiency Challenges

- Rising labour, energy, and raw material costs
- Need for continuous process optimization
- Balancing cost-cutting with maintaining product quality

3. Technological Integration & Digitalization

- Implementing AI, IoT, and automation in operations
- Managing cybersecurity risks and data privacy
- High costs of technology adoption and employee training

4. Workforce Management Issues

- Shortage of skilled labour in manufacturing and service sectors
- Employee resistance to automation and change
- Managing hybrid work models and employee engagement

5. Sustainability & Environmental Regulations

- Reducing carbon footprint and waste generation
- Complying with stringent environmental laws
- Shifting towards circular economy models (recycling and reusing resources)

6. Quality & Customer Satisfaction

- Meeting rising customer expectations for personalized products
- Ensuring consistency in product and service quality
- Managing returns and reverse logistics

7. Risk & Crisis Management

- Preparing for unexpected events like natural disasters and cyberattacks
- Ensuring business continuity through contingency planning
- Managing operational risks in uncertain economic conditions

LECTURE 9	CO1	PO1, PO2,PO4

World-Class Manufacturing (WCM) Practices

World-Class Manufacturing (WCM) refers to a set of best practices and methodologies used by leading global companies to achieve superior operational performance, efficiency, and quality. It focuses on continuous improvement, waste reduction, and customer satisfaction.

Key Practices of World-Class Manufacturing

1. Lean Manufacturing

- Eliminates waste (Muda) in processes
- Uses Just-In-Time (JIT) to reduce inventory costs
- Implements 5S methodology (Sort, Set in Order, Shine, Standardize, Sustain) for workplace efficiency

2. Total Quality Management (TQM)

- Focuses on continuous quality improvement
- Uses customer feedback to enhance products and services
- Encourages employee involvement in quality control

3. Six Sigma

- Reduces process variation and defects
- Uses DMAIC (Define, Measure, Analyze, Improve, Control) methodology
- Improves decision-making using data-drive n analysis

4. Total P roductive Maintenance (TPM)

- Ensures equipment reliability and efficiency
- Involves autonomous maintenance by employees
- Reduces downtime and increases productivity

5. Agile & Flexible Manufacturing

- Quickly adapts to changing customer demands
- Uses modular and reconfigurable production systems
- Enhances product customization capabilities

6. Smart Manufacturing & Industry 4.0

- Integrates AI, IoT, and automation in manufacturing
- Uses predictive maintenance to prevent machine failures
- Implements digital twins for real-time process monitoring

7. Just-In-Time (JIT) Production

- Produces goods only when needed to minimize waste
- Reduces excess inventory and storage costs
- Enhances responsiveness to customer demands

8. Sustainable & Green Manufacturing

- Focuses on eco-friendly production methods
- Reduces carbon footprint and energy consumption
- Implements circular economy practices (recycling, waste reduction)

9. Employee Involvement & Continuous Improvement (Kaizen)

- Encourages employee participation in decision-making
- Implements continuous small improvements over time
- Develops a problem-solving culture at all levels

10. Supply Chain Optimization

- Builds resilient and diversified supplier networks
- Uses r eal-time tracking for inventory and logistics
- Reduces lead times and enhances delivery reliability

Benefits of World-Class Manufacturing

- **Higher Productivity & Efficiency** – Optimized processes reduce waste and improve performance.
- **Better Quality & Customer Satisfaction** – Continuous improvement ensures high-quality products.
- **Cost Reduction** – Efficient resource utilization lowers operational costs.
- **Faster Response to Market Changes** – Agile systems adapt to demand fluctuations.
- **Sustainability & Compliance** – Green manufacturing ensures regulatory adherence.

UNIT II
OPERATIONS AND THE VALUE CHAIN

SYLLABUS

Capacity Planning — Long range, Types, Developing capacity alternatives, tools for capacity planning. Facility Location – Theories, Steps in Selection, Location Models. Sourcing and procurement - Strategic sourcing, make or buy decision, procurement process, managing vendors.

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Meaning of Capacity Planning:

Capacity planning refers to the process of assessing the capacity of a company's resources to ensure they meet future demand. It involves determining how much output a company can achieve with the available resources, and whether adjustments are necessary to meet future demands.

Thus, Capacity Planning is the process of determining the production capacity needed by an organization to meet future demands for its products or services. It involves understanding and forecasting the resources (such as labor, equipment, and facilities) needed to produce goods or services efficiently.

Needs of Capacity Planning:

- **Demand Fulfillment**: To ensure that the company has enough resources (such as workforce, machinery, etc.) to meet the demand for its products or services.
- **Cost Efficiency**: To avoid underutilization (which leads to wasted resources) or overutilization (which can lead to burnout and poor performance).
- **Growth Management**: To ensure the business can scale up or down depending on market conditions and demand.
- **Competitive Advantage**: Ensures a company can respond quickly and effectively to market changes and opportunities.

Objectives of Capacity Planning:

- **Meeting Customer Demand**: The primary goal is to align production capacity with market demand.
- **Minimizing Costs**: Efficient capacity utilization reduces unnecessary overhead costs.
- **Maximizing Efficiency**: Ensuring that resources are used optimally without bottlenecks or waste.
- **Flexibility**: Maintaining the ability to adjust to demand fluctuations without significant losses or delays.

- **Avoiding Overcapacity**: Preventing a situation where excess resources are idle and unproductive.

Levels of Capacity Planning:

Capacity planning can occur at different levels within an organization:

- **Strategic Level**: Long-term, large-scale planning. It involves decisions on facility location, major equipment purchases, and overall capacity expansion.
- **Tactical Level**: Medium-term, focuses on adjusting production rates and capacity to meet market forecasts. Includes decisions such as staffing levels, equipment maintenance, and temporary capacity adjustments.
- **Operational Level**: Short-term decisions aimed at handling immediate demand fluctuations. This includes daily scheduling, resource allocation, and immediate shifts in operations to manage capacity.

Long-Range Capacity Planning:

Long-Range Capacity Planning refers to the process of planning for an organization's capacity needs over an extended period, typically 3 to 5 years or even longer. This type of planning focuses on strategic decisions regarding the acquisition of resources, infrastructure, and technologies to meet future demand. It involves large-scale, significant investments and helps ensure that an organization can continue to operate efficiently and effectively as it grows and responds to market changes. It typically involves:

- Major capital investments in facilities, machinery, and technology.
- Strategic expansion into new markets or products.
- Forecasting growth trends and estimating future resource requirements.
- Developing infrastructure to support future demand.

Objectives of Long-Range Planning:

- Forecasting future demand.
- Identifying potential capacity gaps and making investments to close them.
- Ensuring a sustainable competitive advantage through expansion and technology adoption.

Types of Capacity Planning:

- **Lead Strategy**: Involves planning for excess capacity by expanding resources in anticipation of future demand increases. This is often used when rapid growth is expected.
- **Lag Strategy**: Involves waiting until demand has increased before investing in new capacity. It minimizes investment risk but can lead to missed opportunities if demand increases unexpectedly.
- **Match Strategy**: A hybrid approach where capacity is adjusted incrementally in line with demand changes, using forecasting to balance demand and supply.

Steps in Capacity Planning:

The steps in capacity planning include:

1. **Forecasting Demand**: Predict future demand using historical data, market trends, and other predictive models.
2. **Assessing Current Capacity**: Evaluate the organization's existing capacity (e.g., facilities, equipment, labor) and identify any gaps.
3. **Identifying Capacity Constraints**: Determine where the organization is limited in terms of production or resource usage (e.g., machine capacity, labor availability).
4. **Developing a Plan**: Create a capacity plan that addresses any identified gaps or constraints. This may involve acquiring new equipment, hiring additional workers, or upgrading facilities.
5. **Implementing the Plan**: Put the plan into action by making necessary adjustments to resources, processes, or infrastructure.
6. **Monitoring and Adjusting**: Regularly monitor performance and capacity utilization to ensure the plan is effective and make adjustments if necessary.

Capacity alternatives

Capacity alternatives refer to the different options a business can consider to increase or adjust its production or service capacity in response to changes in demand. These alternatives help ensure that a company has the right amount of resources—such as equipment, facilities, labor, and technology—at its disposal to meet future demand effectively. Each capacity alternative comes with its own set of advantages, risks, costs, and implementation timelines.

Common Capacity Alternatives

1. **Increasing the Use of Existing Capacity (Efficiency Improvements)**:

   Enhancing the efficiency of current resources to increase capacity without significant capital investment. This can include improving processes, optimizing workflows, or increasing the operational hours of existing facilities.

   - **Examples**:
     - **Increasing Working Hours**: Extending shifts, running 24/7 operations, or adding overtime.
     - **Process Improvement**: Streamlining production lines, upgrading machinery, or eliminating bottlenecks to improve throughput.
     - **Training and Cross-Training Employees**: Increasing labor productivity by enhancing skills and reducing downtime.

2. **Expanding Existing Facilities**:
   Upgrading or adding to existing facilities to accommodate greater production or service demands. This may involve adding new equipment, production lines, or increasing space.
   - **Examples**:

- **Adding Production Lines**: Installing more machinery or expanding an assembly line to increase production capacity.
- **Expanding Warehouse Space**: Increasing storage or logistics capacity to support higher inventory levels.
- **Adding Storage/Distribution Capacity**: Expanding distribution or fulfillment centers for faster delivery times.

3. **Building New Facilities**:
   Constructing new facilities, such as factories, warehouses, or service centers, to increase capacity, often in a new geographic location.

   - **Examples**:
     - **Building a New Manufacturing Plant**: Establishing a new factory to meet growing demand.
     - **Opening New Locations**: Expanding into new markets or regions with physical stores or service centers to serve local demand.
     - **New Distribution Centers**: Opening additional hubs to speed up delivery times and reduce transportation costs.
4. **Outsourcing or Contracting**:

   Partnering with external suppliers or service providers to increase capacity, especially during periods of high demand. This alternative allows a company to meet demand without investing heavily in new facilities or infrastructure.

   - **Examples**:
     - **Outsourcing Production**: Contracting external manufacturers to handle some production processes, especially during peak seasons.
     - **Third-Party Logistics**: Outsourcing warehousing, packaging, or distribution functions to third-party logistics (3PL) providers.
     - **Temporary Labor or Contractors**: Hiring temporary staff or contractors during periods of high demand to meet labor requirements.

5. **Investing in Technology**:
   Adopting new technologies, automation, or systems that allow the company to produce more with existing resources or streamline operations to increase efficiency.

   - **Examples**:
     - **Automation and Robotics**: Using robots or automated machinery to handle repetitive tasks, speeding up production without adding labor.
     - **Cloud Computing or Software Solutions**: Implementing advanced enterprise resource planning (ERP) systems or other software to improve capacity planning, resource allocation, and production scheduling.
     - **Artificial Intelligence (AI) and Data Analytics**: Using AI to predict demand patterns, optimize production schedules, and reduce waste.

6. **Outsourcing Customer Services or Support**:
   Outsourcing non-core activities such as customer service or tech support to third parties to free up resources and ensure that the company can focus on core activities, such as production and distribution.

   - **Examples**:
     - **Outsourcing Customer Support**: Hiring a call center or virtual customer support service to manage inquiries during peak demand periods.
     - **Using External Contractors for IT Services**: Contracting out IT support or software development to scale quickly and avoid delays.

7. **Hiring Additional Labor**:
   Increasing the workforce to accommodate higher demand. This can include both full-time and temporary workers.

   - **Examples**:
     - **Hiring Seasonal Workers**: Bringing in extra staff during peak seasons to increase production capacity (common in retail and manufacturing).
     - **Permanent Hiring**: Recruiting full-time employees to support long-term capacity needs in areas where demand is expected to grow steadily.
     - **Temporary Staffing Agencies**: Using temp agencies to quickly add capacity for short-term demand spikes.

8. **Shared Capacity or Joint Ventures**:
   Partnering with another organization to share resources or production capacity, often through joint ventures, partnerships, or co-location arrangements.
   - **Examples**:
     - **Joint Ventures**: Two companies collaborate to build a new facility or share production capacity to meet mutual demands.
     - **Co-Manufacturing**: Partnering with another manufacturer to produce products or components on a shared production line.

9. **Outsourcing Research and Development (R&D) or Product Design**:
   Partnering with external firms to handle product development and innovation, reducing the burden on internal teams and allowing the company to focus on production and service delivery.
   - **Examples**:
     - **External R&D Partnerships**: Collaborating with specialized firms or universities to innovate new products while focusing internal resources on manufacturing.
     - **Design Services**: Outsourcing product design and prototyping to third parties to speed up the development process and meet changing market needs.

10. **Increasing Inventory**:
    Maintaining higher levels of inventory to buffer against capacity constraints or demand spikes. This is often a short-term solution but can help manage sudden increases in demand.
    - **Examples**:
        - **Safety Stock**: Holding extra inventory to smooth out production or supply chain disruptions.
        - **Finished Goods Inventory**: Maintaining an inventory of finished goods to be able to meet customer demand quickly without waiting for production.

Developing capacity alternatives

Developing capacity alternatives, evaluating them, and selecting the best one is a crucial aspect of **capacity planning**. It involves identifying different options for increasing capacity to meet future demand, analysing each alternative's potential, and choosing the best one based on a set of criteria that aligns with the company's strategic goals. This ensures that the company has the resources necessary to meet customer demand without underutilizing or overburdening its resources.

Developing Capacity Alternatives

Developing capacity alternatives involves brainstorming and outlining several potential ways to increase or adjust the organization's capacity to meet future demand. This is usually done after assessing the current capacity and forecasting future demand.

Capacity alternatives can include:

- **Expanding Existing Facilities**: This could involve adding new production lines, upgrading current equipment, or improving current facilities.
- **Adding New Facilities**: If the current location is limited, new plants or service centers can be built in different regions or locations.
- **Outsourcing or Contracting**: In some cases, it may be more cost-effective to outsource production to third-party providers or enter into contracts with other companies for additional capacity when demand surges.
- **Investing in Technology**: Upgrading to more advanced technology or automation can help increase capacity without the need for additional physical space or labour. This might involve adopting artificial intelligence, robotics, or cloud computing solutions.
- **Hiring More Employees**: If labour is a limiting factor, increasing staffing levels or bringing in temporary workers can help meet capacity needs.
- **Increasing Operating Hours**: This could include running shifts around the clock, or adding weekend or overtime shifts, to better utilize existing resources.
- **Upgrading or Replacing Equipment**: Investing in more efficient, higher-capacity machinery can lead to a significant increase in production capacity.

Evaluating Capacity Alternatives

Once the capacity alternatives are developed, they need to be evaluated based on various criteria to determine how well they meet the organization's objectives, resources, and constraints. Here's how you can evaluate them:

Key Factors to Evaluate Capacity Alternatives**:**

1. **Cost**:
    - Evaluate the financial cost of each alternative. This includes both capital investment (e.g., buying equipment or building new facilities) and operational costs (e.g., hiring additional employees or paying for overtime).
    - Consider the **Return on Investment (ROI)** or **payback period** to assess how long it will take for the investment to pay off.
2. **Lead Time**:
    - How long will it take to implement the alternative and achieve the desired increase in capacity? For instance, building new facilities or installing new machinery might take several months or even years.
    - Shorter lead times are often preferable, particularly if there's an urgent demand increase.
3. **Flexibility**:
    - Assess how flexible the alternative is in terms of adapting to future changes. For example, new technologies or outsourcing can often be scaled up or down more quickly compared to building permanent infrastructure like new factories.
    - Flexibility to adjust capacity based on future shifts in demand or economic conditions is an important factor.
4. **Risk**:
    - Consider the potential risks of each alternative. For example, outsourcing production could involve risks related to quality control, supply chain disruptions, or reliance on third-party vendors.
    - The level of investment and long-term commitments should also be factored in, as these can increase the financial risk if the demand doesn't materialize as expected.
5. **Impact on Operations**:
    - Evaluate how each alternative will affect current operations. For instance, upgrading existing facilities may cause temporary downtime, while expanding might require more management oversight.
    - It's important to ensure that the solution does not interfere with day-to-day operations and customer satisfaction.
6. **Capacity Utilization**:
    - Assess the degree to which each alternative will allow the organization to utilize existing resources. For example, adding new shifts or using better technology might allow existing facilities to achieve higher efficiency, whereas building a new facility might result in underutilization if demand forecasts are incorrect.
7. **Strategic Alignment**:
    - Ensure the capacity alternative aligns with the company's long-term goals and strategic vision. For example, if a company's strategy focuses on reducing

environmental impact, alternatives involving sustainability, like energy-efficient technology, may be prioritized over others.

8. **Sustainability**:
    - Consider the environmental and social implications of each alternative. More and more companies are incorporating sustainability goals into their capacity planning, so options that support sustainable growth or that reduce carbon footprints may be favoured.
9. **Scalability**:
    - Evaluate whether the alternative can grow or scale with the business. For example, technology upgrades or outsourcing may allow for easier scaling when demand increases, whereas expanding facilities may have limited capacity after a certain point.

Selecting the Best Capacity Alternative

After evaluating the alternatives, it's time to select the best option. The selection process involves making a decision based on a balance of the factors above and aligning the chosen alternative with the company's objectives.

Steps in Selecting the Best Capacity Alternative**:**

1. **Review Evaluation Results**:
    - Organize the results from the evaluation phase into a structured format (e.g., a decision matrix or weighted scoring model). This helps compare alternatives based on the weighted importance of each factor (e.g., cost, flexibility, risk).
2. **Analyse Cost vs. Benefit**:
    - Look at the potential costs and benefits associated with each alternative. A cost-benefit analysis can help identify which alternatives will provide the greatest return on investment or the fastest payback period.
3. **Consider Strategic Fit**:
    - Evaluate how well the alternative fits with the company's strategic goals. For example, if the organization is aiming for aggressive market expansion, an alternative that can scale quickly would be more suitable.
4. **Seek Stakeholder Input**:
    - Involve key stakeholders, such as department heads, finance, and production managers, in the decision-making process. Their insights into operational challenges and resource needs can help ensure the selected alternative is feasible and practical.
5. **Test Scenarios**:
    - If possible, conduct scenario analysis or simulations to understand how each alternative might perform under various market conditions. This helps ensure that the chosen alternative is resilient in different situations.
6. **Consider Timing**:
    - Timing is a critical aspect of capacity planning. Sometimes the best option might be to expand gradually or implement a solution in phases. A phased approach could reduce risk and allow the company to adapt to changing market conditions.

7. **Make the Final Decision**:
    - After thoroughly reviewing the options and weighing the pros and cons, select the alternative that best aligns with the business's capacity needs, growth plans, and financial constraints.
8. **Plan for Implementation**:
    - Once the best alternative is selected, develop a detailed implementation plan. This should include timelines, resources, roles, and responsibilities for executing the plan, along with mechanisms for monitoring progress and adjusting if necessary.

Factors Affecting Capacity Planning

Capacity planning is influenced by a wide range of factors that impact the ability of an organization to meet future demand effectively. These factors must be carefully considered when planning for the right level of resources, both in terms of physical infrastructure and human resources.

Here are the key factors affecting capacity planning:

1. **Demand Forecasting**:
    - Accurate demand forecasting is one of the most critical factors. If the forecast is inaccurate, it can lead to either overcapacity (leading to unnecessary costs) or under capacity (leading to missed sales or delays in delivery).
    - Companies use historical data, market trends, and advanced analytics to predict future demand.
2. **Technology**:
    - The type and age of technology being used in production or service processes play a significant role in capacity planning. Advanced technologies such as automation, AI, and robotics can increase capacity without requiring much additional space or labour.
    - Technological advancements can change production processes and lead to the need for new capacity plans.
3. **Availability of Resources**:
    - Availability and access to resources (e.g., raw materials, skilled labor, and capital) directly affect the ability to meet production or service requirements.
    - Limitations in the supply chain or labor market can constrain capacity.
4. **Production and Service Processes**:
    - The design and efficiency of production or service processes affect capacity planning. Efficient processes with minimal bottlenecks allow better utilization of available capacity.
    - Complex, manual, or inefficient processes may require more capacity or investments in process optimization.
5. **Facilities and Infrastructure**:
    - The existing infrastructure, such as factory space, machinery, and equipment, can either enable or limit capacity. Insufficient space, outdated machinery, or poor layout design can limit the ability to scale up production or services.

    - Additionally, expansion of existing facilities or building new ones will impact capacity planning.
6. **Labor Availability and Skills**:
    - Labor is a critical resource in capacity planning. The availability of skilled workers and labor unions can influence how quickly the company can ramp up production or service capacity.
    - High turnover rates, labor shortages, or skill gaps can limit the company's capacity to meet demand.
7. **Regulations and Legal Constraints**:
    - Local, national, and international regulations can impact capacity planning, such as environmental laws, worker safety regulations, zoning laws, and industry-specific standards.
    - Regulations may limit the amount of work that can be done in a facility or impose limits on working hours.
8. **Financial Resources**:
    - The availability of capital to invest in capacity expansion, whether through internal cash flow or external financing, is a key factor. Expanding capacity often requires substantial upfront investment, such as building new facilities or purchasing new equipment.
    - Financial constraints can limit the capacity expansion options available to the company.
9. **Lead Time for Expansion**:
    - The time it takes to implement new capacity solutions (e.g., purchasing equipment, building new facilities, or hiring additional labour) must be factored into planning. If the lead time is long, businesses may need to start capacity expansion well in advance of the demand increase.
10. **Market Conditions and Competition**:

- Changes in market conditions, such as economic downturns or booms, can directly affect demand and, consequently, capacity requirements. Additionally, competition in the industry may push companies to invest in more capacity to remain competitive.
- External factors like customer preferences, trends, and technology shifts can change demand quickly, requiring agile capacity planning.

11. **Supply Chain Constraints**:

- Supply chain disruptions, such as shortages of key materials, transportation delays, or geopolitical issues, can affect the company’s ability to expand capacity as planned.
- Effective supply chain management and diversification of suppliers can help mitigate these risks.

Tools for Capacity Planning

Several tools can aid in capacity planning, helping businesses evaluate, analyse, and make decisions on the optimal level of resources required to meet future demand. Some of the most widely used tools include:

1. **Capacity Planning Software**:
    - These are specialized software tools designed to model capacity needs based on demand forecasts. They offer real-time data and analytics, helping businesses make data-driven decisions.
    - Examples: **Oracle Capacity Management, SAP Integrated Business Planning (IBP), Microsoft Excel** (with capacity planning templates), **Katana capacity management software.**
2. **Workload Analysis**:
    - Workload analysis involves evaluating the demand for various tasks or processes within a business. By analysing the expected volume of work for different departments (e.g., manufacturing, customer service), you can determine whether current capacity will be sufficient.
    - It often involves data visualization to show where bottlenecks are likely to occur and how to redistribute resources.
3. **Demand Forecasting Tools**:
    - These tools help businesses predict future demand based on historical data, market trends, and other predictive analytics. By forecasting demand, companies can better align their capacity to meet future needs.
    - Examples: **Forecasting models in Excel, Demand Solutions, Forecast Pro, SAP Integrated Business Planning (IBP).**
4. **Simulation Models**:
    - Simulation models allow businesses to model different scenarios of capacity planning, including variations in demand, resource availability, and production efficiency. By running simulations, businesses can evaluate the impacts of different capacity strategies before implementation.
    - Examples: **Arena Simulation, Simul8, AnyLogic.**
5. **Break-even Analysis**:
    - A break-even analysis helps determine the point at which the cost of expanding capacity (such as adding new facilities or buying equipment) will be offset by increased revenues. It helps determine whether a capacity investment is financially viable.
    - This tool involves calculating fixed and variable costs and determining the production level at which the business will break even.
6. **Resource Requirement Planning (RRP)**:
    - Resource requirement planning is used to assess the capacity needed for various resources (e.g., personnel, equipment, materials) to meet projected demand.
    - It typically includes tools such as Gantt charts or resource histograms that illustrate when resources will be required and help identify when to acquire additional resources.
7. **Inventory Management Systems**:
    - These systems are used to track the inventory levels of raw materials and finished goods. By monitoring inventory in real-time, businesses can determine if additional capacity is needed to meet customer demand or if inventory levels are too high and unnecessary capacity exists.
    - Examples: **TradeGecko, Fishbowl Inventory, SAP ERP Inventory Management**.
8. **Overall Equipment Effectiveness (OEE)**:

- OEE is a measure of how effectively a manufacturing operation is utilized compared to its full potential. It considers factors such as availability, performance, and quality. High OEE indicates that existing equipment is being used efficiently, while low OEE may signal the need for additional capacity or better resource utilization.

Importance of Capacity Planning

Capacity planning is crucial for businesses to ensure they can meet customer demand efficiently and cost-effectively. It has several key benefits:

1. **Avoid Over capacity or Under capacity**:
   - Effective capacity planning helps organizations avoid the costs associated with overcapacity (e.g., unused resources) and under capacity (e.g., missed sales and dissatisfied customers).
2. **Cost Efficiency**:
   - By aligning capacity with demand, companies can avoid wasting resources on unnecessary investments, leading to cost savings and improved profitability.
3. **Improved Decision-Making**:
   - Capacity planning provides decision-makers with the data and insights needed to make informed choices regarding resource allocation, production schedules, and investment in infrastructure.
4. **Better Customer Service**:
   - With proper capacity planning, businesses are better positioned to deliver products or services on time, which improves customer satisfaction and loyalty.
5. **Agility and Flexibility**:
   - A well-designed capacity plan enables companies to quickly adjust to changes in demand or market conditions, providing the flexibility to scale operations up or down as needed.
6. **Risk Mitigation**:
   - Capacity planning helps mitigate risks related to resource shortages, supply chain disruptions, or changes in market demand by proactively addressing potential challenges before they become problems.
7. **Long-term Growth**:
   - Long-term capacity planning supports sustainable business growth by ensuring the company has the necessary resources to scale and expand operations effectively.

Facility location

Facility location refers to the process of determining the most optimal geographical location for a business or manufacturing facility. This is a crucial decision for businesses as it directly influences operating costs, transportation efficiency, supply chain management, and overall competitiveness. The facility can refer to a warehouse, retail outlet, distribution center, factory, or service center.

The **facility location decision** impacts various aspects of a business, including:

- **Cost Efficiency**: Minimizing costs for transportation, labour, energy, and taxes.
- **Customer Proximity**: Being close to the target market to reduce delivery times and costs.
- **Labour Availability**: Ensuring the availability of skilled labour at competitive wage rates.
- **Infrastructure**: The presence of roads, ports, utilities, and other necessary infrastructure.

A facility's location can significantly influence its success or failure by impacting operational efficiency, customer satisfaction, and long-term profitability.

Key Factors Affecting Facility Location Decisions

1. **Proximity to Markets**: Being close to customers can minimize transportation costs and enhance delivery times.
2. **Labour Costs and Availability**: The skill set and cost of the local labour pool are important for many businesses, especially those in manufacturing or services.
3. **Transportation Access**: The ease of access to transportation networks (highways, railroads, airports, ports) is critical for both raw material supply and product distribution.
4. **Energy Availability**: Energy costs and availability, such as electricity and gas, play a major role in industries that are energy-intensive.
5. **Tax Incentives**: Governments may offer tax incentives, subsidies, or grants to encourage businesses to set up operations in certain areas.
6. **Environmental and Regulatory Factors**: Environmental regulations and local zoning laws may affect where a business can locate its facility.

Theories of Facility Location

Several theories and models have been developed to guide the decision-making process for facility location. Some of the most prominent ones include:

1. **Center of Gravity Model**:
    - The **Center of Gravity Model** aims to minimize transportation costs by finding the central point that minimizes the distance to multiple supply and demand points. It is useful when dealing with a network of suppliers and customers.
2. **Gravity Model**:
    - This model uses the principles of physics, where the attractiveness of a location is based on the "gravity" it exerts due to its size and distance. It helps predict customer flows or the movement of goods between locations based on the "attraction" (demand) of each location and their distances.
    - Formula:
3. **Linear Programming Model**:
    - Linear programming is used to optimize the location of a facility by minimizing costs subject to constraints such as transportation costs, supply, demand, and capacity. The aim is to find the location that minimizes total costs while meeting customer demand and production capacity constraints.
4. **Transportation Model**:
    - The transportation model focuses on minimizing transportation costs while determining the most cost-effective way to distribute goods from multiple suppliers to multiple demand points. This method assumes that transportation costs depend on the quantity of goods transported between locations.
    - It is often solved using techniques such as the **Simplex method** or **Northwest Corner Rule**.
5. **P-Median Problem**:

    - The P-median problem is a combinatorial optimization problem where the goal is to select **P** locations for facilities that minimize the total distance or cost of serving customers. This is often applied in situations where a company wants to optimize the number of facilities required while considering the distribution of demand.
6. **K-Mean Clustering**:
    - **K-means clustering** is a machine learning algorithm used in facility location decisions, where it can group customer demand or supplier points into clusters and identify the optimal central facility locations. This is particularly helpful when there is uncertainty in demand and multiple locations need to be considered simultaneously.

Practical Application of Facility Location

In practice, facility location models are used by businesses when expanding or optimizing their operations. Some common applications include:

- **Retail Expansion**: Deciding where to open new stores based on customer density, demographics, and competition.
- **Manufacturing**: Choosing a location for factories to minimize logistics costs and labour expenses.
- **Warehousing and Distribution**: Identifying the best locations for warehouses or distribution centers to serve various markets efficiently.
- **Global Supply Chain**: Multinational companies use facility location models to optimize global supply chains, considering factors like trade barriers, political stability, and tariffs.

Steps in Selection of Facility Location

Selecting the right location for a facility involves a strategic decision-making process. The steps in selecting a facility location typically include:

1. **Define Objectives and Criteria**:
    - **Objective Setting**: Clearly define the goals of the facility, whether it's for cost reduction, market expansion, or operational efficiency.
    - **Criteria Development**: Establish the factors that are important for the business, such as cost, proximity to customers, labor availability, etc. These criteria will guide the evaluation of potential locations.
2. **Identify Potential Locations**:
    - **Market Research**: Gather data on possible locations through research. This may involve looking at geographic areas, regions, or even international markets that meet the basic business needs.
    - **Preliminary Screening**: Conduct an initial filter to rule out locations that are not feasible based on broad criteria, such as zoning laws, political stability, or high operational costs.
3. **Evaluate Locations Based on Key Factors**:
    - **Cost Assessment**: Analyse costs related to each location, such as labour, real estate, utility rates, and taxes.
    - **Access to Markets**: Examine the potential to reach target customers quickly and cost-effectively.
    - **Labour Availability and Skills**: Evaluate the local labour market for its size, skill level, cost, and unionization.

    - **Infrastructure and Transportation**: Assess the quality of transportation networks (roads, rail, air, or sea) and utilities like electricity and water.
4. **Conduct a Detailed Feasibility Study**:
    - **Cost-Benefit Analysis**: Perform an in-depth financial analysis of each location. Compare the costs and potential revenue, factoring in aspects like supply chain efficiency, market size, and operating costs.
    - **Risk Assessment**: Identify and evaluate risks, such as political instability, natural disasters, or regulatory changes, that could impact the location's viability in the long term.
5. **Select the Optimal Location**:
    - After evaluating all factors and comparing various alternatives, choose the location that aligns most closely with the business goals and offers the greatest potential for long-term success.
    - **Make a Decision**: Based on the analysis, make the final decision on the facility's location.
6. **Plan the Facility Layout**:
    - After selecting the location, work on designing the physical layout of the facility to ensure operational efficiency. This includes designing the space for optimal workflow, equipment placement, and safety considerations.
7. **Implementation and Setup**:
    - Once the location is selected, begin planning for the construction, recruitment, and operational setup of the facility. This includes acquiring necessary permits, hiring employees, and purchasing equipment.
8. **Ongoing Monitoring and Evaluation**:
    - After the facility is operational, continue to monitor the performance of the location. Track factors like production efficiency, transportation costs, and customer satisfaction to ensure that the location decision remains optimal.

Factors Affecting Facility Location

The decision to select a facility location depends on multiple factors, ranging from economic to strategic considerations. Here are the key factors that affect facility location decisions:

1. Proximity to Markets:

- Being close to target customers or markets can reduce transportation costs and lead to faster delivery times. This is particularly important for businesses dealing with perishable goods or those with a need for rapid customer response.
- Market proximity can also influence customer satisfaction and service levels.

2. Transportation Costs:

- The availability and cost of transportation are critical factors in facility location decisions. Locations near highways, ports, railroads, and airports offer easier and cheaper access to supply chains, raw materials, and end customers.
- Transporting goods over long distances can add significant cost, so minimizing this is key for many businesses.

3. Labour Availability and Cost:

- Access to a skilled and cost-effective labour pool is often a deciding factor, especially for manufacturing, tech, or service-based industries.
- Labour costs, union presence, and employee availability can vary by region, influencing where companies choose to set up operations.

4. Energy Availability and Cost**:**

- For industries that require high energy consumption (e.g., manufacturing), energy availability, cost, and reliability are crucial. Some areas may offer cheaper electricity rates, while others may have abundant renewable energy resources.

5. Tax Incentives and Government Policies**:**

- Many governments offer tax breaks, subsidies, or incentives to encourage companies to set up operations in certain areas. These incentives can be a decisive factor, especially for capital-intensive industries.
- Local zoning laws, business regulations, and trade restrictions should also be evaluated to avoid potential legal hurdles.

6. Land and Real Estate Costs**:**

- The cost of land or real estate is another important factor, especially for industries that require large physical spaces. Some regions may offer lower land prices or offer prime locations at competitive rates.
- The size and nature of the land (flat, accessible, and safe from natural disasters) should also be considered.

7. Infrastructure:

- The availability of essential infrastructure, such as water, electricity, roads, telecommunications, and waste management systems, is vital for the smooth functioning of a facility. Areas with well-developed infrastructure offer a stable environment for businesses to operate.

8. Climate and Environmental Conditions:

- The local climate, natural resources, and environmental conditions can play a role in selecting a location. Some industries, such as agriculture, may need to be located in specific climates, while other industries may consider environmental factors for their operations.
- Natural disasters, such as floods, earthquakes, or hurricanes, can be a risk for certain locations and should be accounted for in the decision-making process.

9. Competitive Environment:

- The location of competitors and other similar businesses can influence the choice. For example, clustering in an area with other companies in the same industry (a "hub") may offer opportunities for collaboration, talent pooling, or shared resources.
- On the other hand, a business might avoid regions with too much competition, where market saturation could make it more difficult to succeed.

10. Political and Economic Stability**:**

- Political stability and economic conditions in a location play a major role in the long-term success of the facility. Regions with unstable governments, frequent changes in policies, or high inflation rates may pose risks for businesses.
- Economic conditions such as GDP growth, consumer spending, and access to international markets can also influence the location decision.

11. Quality of Life**:**

- For businesses that require the relocation of employees, factors like the quality of life in a region can be important. Areas with good healthcare, education, and recreational opportunities are more likely to attract skilled employees.
- The cost of living and housing availability may also influence employees' willingness to move.

12. Legal and Regulatory Considerations**:**

- Local, state, and national regulations regarding labour laws, environmental regulations, and product safety can affect the decision. It's crucial to assess how these regulations may impact operations and compliance costs.

Need for Selection of Location

The selection of a facility location is a critical decision that can significantly impact a business's success. It's not just about choosing a place where the company will operate; it's about selecting a location that aligns with the company's strategic goals and enhances its competitiveness. Below are some key reasons why selecting the right location is crucial:

1. *Cost Optimization:*

- **Operational Costs**: The location of a facility can heavily impact operational costs, including transportation, labour, utilities, and real estate. Selecting a location with lower costs can lead to significant savings in the long term.
- **Logistics and Distribution Costs**: Being close to suppliers and customers can reduce transportation expenses and improve supply chain efficiency.

2. *Access to Market and Customer Base:*

- **Proximity to Markets**: Being close to target markets can improve customer satisfaction by reducing delivery times and transportation costs. It can also increase the ability to respond quickly to market demands.
- **Market Expansion**: For businesses looking to expand into new markets, selecting a location close to emerging markets or untapped regions can create opportunities for growth.

3. *Labour Availability and Cost:*

- Availability of skilled labour at a competitive cost is a major factor. A good location provides access to a pool of qualified workers, especially in regions with specialized industries or technical expertise.
- Labour cost differences between regions (such as wages and benefits) also play a significant role in facility location decisions.

4. *Infrastructure and Accessibility:*

- Well-developed infrastructure—roads, highways, railways, ports, and airports—enables efficient movement of goods and people, making the location more accessible for suppliers, employees, and customers.
- Adequate utilities such as electricity, water, gas, and telecommunications are vital to ensure smooth operations.

5. *Regulatory and Tax Benefits:*

- Different regions or countries offer various incentives like tax breaks, grants, or subsidies to attract businesses. A favourable regulatory environment can reduce compliance costs and enhance the ease of doing business.
- Being aware of local laws, environmental regulations, and zoning requirements is essential to avoid legal issues.

6. *Risk Mitigation:*

- Selecting a location that is geographically safe from natural disasters (like floods, earthquakes, or hurricanes) is essential to mitigate risks that could disrupt operations.
- Political stability, the legal environment, and the risk of civil unrest also play a role in the long-term viability of a location.

7. *Competitive Advantage:*

- Location decisions can influence a company's competitive position. Being located near key competitors, suppliers, or partners can foster collaboration and innovation, while being in a less competitive area may allow a business to dominate that market.
- Being in a strategic location can improve brand image, customer perception, and overall business reputation.

Location Models

Location models are mathematical and computational approaches that help businesses make data-driven decisions regarding the optimal facility location. These models take into account various factors like transportation, cost, customer demand, and logistics to determine the best site for a facility. Below are some common location models:

1. Center of Gravity Model

- **Purpose**: The Center of Gravity model is used to determine the optimal location of a facility by minimizing transportation costs. It finds a point (center of gravity) that minimizes the total distance from the facility to various demand points (customers or suppliers).
- **Application**: It's commonly used in logistics and distribution centers.

2. Gravity Model

- **Purpose**: The Gravity model uses principles of physics to model the interaction between locations based on their "gravitational" pull. The "gravity" depends on the size (population or demand) of the locations and the distance between them.
- **Application**: Often used in retail, service centers, or facility siting when trying to predict customer flows or goods movement.

3. Linear Programming (LP) Model

- **Purpose**: Linear programming is used to optimize facility location decisions by minimizing costs (such as transportation, labor, or facility setup costs) while satisfying constraints (such as customer demand, capacity, and resource availability).
- **Application**: Used in complex logistics and distribution networks where multiple factors need to be considered simultaneously.
- **Example**: A company needs to minimize the total cost of supplying goods from several factories to several retail locations while considering constraints like production capacity and transportation limitations.

4. Transportation Model

- **Purpose**: The transportation model is used to minimize the transportation costs of moving goods from multiple suppliers to multiple destinations (e.g., warehouses or customers).
- **Application**: Primarily used in logistics and supply chain management for routing and distribution network design.
- **Example**: A company has several factories and a set of customer locations and needs to find the cheapest way to distribute goods from the factories to customers while considering transportation costs and capacities.

5. P-Median Problem

- **Purpose**: The P-median problem involves selecting **P** facility locations (such as factories, warehouses, or service centers) from a set of potential locations, aiming to minimize the total distance between facilities and demand points (customers, suppliers, etc.).
- **Application**: Often used in retail site selection, public service facility location (like fire stations), and emergency services planning.
- **Example**: A municipality wants to locate **P** fire stations in a way that minimizes the average distance from each residence to the nearest fire station.

6. K-Means Clustering Model

- **Purpose**: The K-means clustering algorithm is used to group demand points into clusters and identify the optimal facility locations based on the clusters' centroids.
- **Application**: It's particularly useful when a company needs to set up multiple locations and wants to cluster demand geographically to optimize service or delivery times.
- **Example**: A retail chain wants to determine the best cities or neighbour hoods to open new stores based on customer density and demand.

7. Maximal Coverage Location Problem (MCLP)

- **Purpose**: The Maximal Coverage Location Problem aims to determine the optimal number and location of facilities to maximize coverage of demand points within a given distance or travel time.
- **Application**: Used in emergency services, retail site selection, and other scenarios where service coverage is a key factor.
- **Example**: A healthcare system wants to optimize the locations of clinics to ensure maximum coverage of the population within a 10-mile radius.

UNIT III

DESIGNING OPERATIONS

SYLLABUS

Product Design - Criteria, Approaches. Product development process - stage-gate approach - tools for efficient development. Process - design, strategy, types, analysis. Facility Layout — Principles, Types, Planning tools and techniques.

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Product Design

Criteria for Product Design

- **Customer Requirements**: The design must fulfill customer expectations in terms of quality, usability, and aesthetics.
- **Functionality and Performance**: Products should perform efficiently and reliably under specified conditions.
- **Aesthetics and Ergonomics**: Appealing design and comfort are crucial for user satisfaction and marketability.
- **Cost and Budget Constraints**: Design must balance performance and cost-effectiveness to remain competitive.
- **Sustainability and Environmental Impact**: Designs should promote eco-friendly materials and processes, reducing waste and energy usage.
- **Manufacturability and Assembly**: Simplifying production and assembly reduces costs and ensures consistency.
- **Reliability and Maintenance**: The design should ensure long product life and ease of maintenance.
- **Compliance and Standards**: Adhering to industry and legal standards ensures product safety and market acceptance.

Approaches to Product Design

- **User-Centered Design**: Involves users throughout the design process to create intuitive and satisfying products.
- **Concurrent Engineering**: Encourages simultaneous development across departments (design, engineering, marketing) to shorten time-to-market.
- **Design for Manufacturing (DFM)**: Focuses on simplifying manufacturing processes and reducing costs.
- **Design for Assembly (DFA)**: Aims to make products easier and quicker to assemble with fewer components.
- **Modular Design**: Breaks down products into interchangeable modules for flexibility and easier upgrades or repairs.
- **Value Engineering**: Systematically analyzes functions to reduce costs without compromising performance.

- **Reverse Engineering**: Studies competitor products to gain insights and improve or innovate existing designs.
- **CAD and Simulation-Based Design**: Computer-aided design tools are used to visualize, test, and refine designs before production.

Product Development Process

Stage-Gate Approach

This method breaks the product development journey into discrete stages, with checkpoints (gates) for evaluation.

- **Idea Generation**: Brainstorming new product ideas from market trends, feedback, or research.
- **Scoping**: Quick analysis of technical feasibility and market potential.
- **Business Case Development**: Detailed analysis involving market research, product definition, and financial projections.
- **Product Development**: Converting ideas into working prototypes and refining based on feedback.
- **Testing and Validation**: Verifying that the product performs as intended and meets user needs.
- **Product Launch**: Full-scale production and introduction of the product to the market.

Tools for Efficient Development

- **Quality Function Deployment (QFD)**: Translates customer requirements into detailed design specifications.
- **Failure Mode and Effects Analysis (FMEA)**: Identifies and mitigates potential product failures.
- **Rapid Prototyping**: Quickly builds and tests models to improve design before final production.
- **Computer-Aided Design (CAD)**: Allows for detailed design and simulations in a virtual environment.
- **Project Management Tools (PERT/CPM)**: Helps in scheduling, resource allocation, and monitoring project timelines.
- **Benchmarking**: Compares products with competitors to identify best practices and improvement opportunities.
- **Value Analysis**: Analyzes cost-to-function ratio to increase product value.

Process Design

Definition of Process Design

Process design involves planning the sequence of operations to efficiently convert inputs into finished products or services.

Process Strategy

- **Process Focus**: Suitable for custom, low-volume production; highly flexible but less efficient.
- **Repetitive Focus**: Combines features of job shops and production lines; efficient for standardized products.
- **Product Focus**: High-volume, low-variation systems; often capital intensive but highly efficient.
- **Mass Customization**: Delivers high-volume products tailored to individual customer needs using flexible processes.

Types of Processes

- **Job Shop**: Handles small batches of customized products; highly flexible but slow.
- **Batch Production**: Produces limited quantities in groups; offers a balance between variety and volume.
- **Assembly Line**: Standardized production with fixed paths; high efficiency and consistency.
- **Continuous Flow**: Nonstop production of highly standardized items (e.g., chemicals, paper).
- **Project Process**: Unique, large-scale efforts with distinct goals and timeframes (e.g., construction projects).

Process Analysis

- **Flowcharting**: Graphically maps out a process to identify inefficiencies or redundancies.
- **Time and Motion Study**: Analyzes tasks and timing to improve worker efficiency.
- **Capacity Analysis**: Determines if existing resources can meet production demand.
- **Bottleneck Identification**: Locates constraints that slow down overall output.
- **Value Stream Mapping**: Identifies all steps in a process, focusing on eliminating non-value-adding activities.
- **Simulation Tools**: Uses software models to predict process behavior under different conditions.

Facility Layout

Principles of Facility Layout

- **Minimize Material Handling**: Reduces transport time, cost, and product damage.
- **Efficient Space Utilization**: Makes optimal use of available space for equipment and storage.
- **Flexibility and Scalability**: Layout should be adaptable to changes in product mix or volume.
- **Safety and Working Conditions**: Ensures compliance with safety standards and employee comfort.
- **Smooth Flow of Materials and Information**: Ensures continuity in the production process.

Types of Facility Layouts

- **Process Layout**: Groups similar machines; flexible but complex to schedule.
- **Product Layout**: Machines arranged based on the production sequence; suitable for mass production.
- **Fixed Position Layout**: Product remains stationary while workers and equipment move around it; used for large products.
- **Cellular Layout**: Workstations arranged in a cell to produce similar products; improves efficiency.
- **Hybrid Layout**: Combines features of various layouts to suit specific needs.

Planning Tools and Techniques

- **Flow Process Charts**: Visual tools showing steps, delays, and material movement in a process.
- **REL Charts (Relationship Charts)**: Illustrate the desired closeness between different departments or functions.
- **From-To Charts**: Analyze the flow of materials or personnel between departments.
- **Computerized Layout Tools (e.g., CRAFT, ALDEP)**: Help generate and evaluate layout alternatives.
- **Simulation and Modeling**: Provide a virtual environment to test layouts before implementation.
- **Line Balancing Techniques**: Allocate tasks evenly across workstations to maximize efficiency and reduce idle time.

UNIT IV

PLANNING AND CONTROL OF OPERATIONS

SYLLABUS

Demand Forecasting — Need, Types, Objectives and Steps - Overview of Qualitative and Quantitative methods. Operations planning - Resource planning - Inventory Planning and Control. Operations Scheduling - Theory of constraints - bottlenecks, capacity constrained resources, synchronous manufacturing

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Demand Forecasting

Need for Demand Forecasting

- **Decision-Making**: Helps management in strategic, tactical, and operational planning.
- **Inventory Management**: Accurate forecasts reduce stockouts and excess inventory.
- **Capacity Planning**: Determines future resource requirements.
- **Financial Planning**: Revenue projections and budgeting rely on demand estimates.
- **New Product Development**: Forecasts help in estimating the potential demand of new products.

Objectives of Demand Forecasting

- **Estimate Future Demand**: To plan production, resources, and procurement.
- **Improve Customer Service**: Ensures product availability as per demand.
- **Minimize Costs**: Optimizes inventory levels and reduces holding costs.
- **Support Strategic Planning**: Assists in expansion, marketing, and diversification decisions.
- **Reduce Uncertainty**: Provides a basis for rational planning and risk management.

Types of Demand Forecasting

- **Short-Term Forecasting**: Typically for periods under 1 year; used for inventory and scheduling.
- **Medium-Term Forecasting**: 1 to 3 years; helps in budgeting and workforce planning.
- **Long-Term Forecasting**: More than 3 years; used for strategic decisions like capacity expansion.

Steps in Demand Forecasting

- **Problem Definition**: Clarify the purpose and scope of forecasting.
- **Data Collection**: Gather relevant historical and market data.
- **Data Analysis**: Clean and analyze data to identify patterns or trends.
- **Selection of Forecasting Method**: Choose between qualitative or quantitative techniques.
- **Forecast Development**: Generate forecast using the chosen method.

- **Monitoring and Evaluation**: Compare forecast against actual results and refine models.

Overview of Qualitative Methods

- **Expert Opinion**: Forecasts based on insights from experienced managers or experts.
- **Market Research**: Surveys and interviews used to estimate demand.
- **Delphi Method**: Structured group communication technique to gather expert consensus.
- **Panel Consensus**: Group discussion among experts to agree on a forecast.
- **Sales Force Composite**: Salespeople estimate demand in their territories.
- **Customer Expectations**: Directly asks customers about their future buying plans.

Overview of Quantitative Methods

- **Time Series Analysis**: Uses historical data to forecast future demand (e.g., moving averages, exponential smoothing).
- **Causal Models**: Analyzes cause-and-effect relationships (e.g., regression analysis).
- **Trend Analysis**: Identifies patterns over time to project future values.
- **Econometric Models**: Uses economic variables and statistical models to estimate demand.
- **Simulation Models**: Creates scenarios using various assumptions to forecast demand.

Operations Planning

Resource Planning

- **Definition**: Ensures that an organization has the right quantity and type of resources (materials, machines, labor) at the right time.
- **Types**:
    - **Rough-Cut Capacity Planning (RCCP)**: Checks whether key resources are available to meet production plans.
    - **Aggregate Planning**: Medium-term planning balancing demand and capacity.
    - **Capacity Requirements Planning (CRP)**: Determines the capacity needed at work centers.
    - **Enterprise Resource Planning (ERP)**: Integrated system that manages all resources across the enterprise.

Inventory Planning and Control

- **Purpose**: Maintain optimal inventory levels to meet demand without overstocking.
- **Types of Inventory**:
    - Raw materials
    - Work-in-progress (WIP)
    - Finished goods
    - MRO (Maintenance, Repair, Operations) inventory
- **Inventory Control Techniques**:

    - **ABC Analysis**: Categorizes inventory based on value and usage.
    - **Economic Order Quantity (EOQ)**: Determines the optimal order size that minimizes total inventory cost.
    - **Reorder Point (ROP)**: Inventory level that triggers a new order.
    - **Just-In-Time (JIT)**: Minimizes inventory by receiving goods only when needed.
    - **Material Requirements Planning (MRP)**: Calculates material needs based on production schedules.
- **Performance Metrics**:
    - Inventory Turnover Ratio
    - Fill Rate
    - Stock-out Rate
    - Average Inventory

Operations Scheduling

Definition and Purpose

- Scheduling involves assigning resources to tasks over time to ensure efficient production.
- Ensures timely completion of jobs, minimizes work-in-progress, and maximizes equipment utilization.

Theory of Constraints (TOC)

- **Core Idea**: Every process has at least one constraint (bottleneck) that limits throughput.
- **Goal**: Identify and manage constraints to improve system performance.

Key Concepts

- **Bottlenecks**: Any resource whose capacity is less than the demand placed upon it. It determines the system's maximum output.
- **Non-Bottlenecks**: Resources that have more capacity than demand; do not limit output.
- **Capacity-Constrained Resources (CCRs)**: Resources that may become bottlenecks depending on the load or schedule.

Synchronous Manufacturing

- **Definition**: Production system where the entire process is aligned to the pace of the constraint.
- **Focus**: Maximizing throughput, minimizing inventory, and reducing operational expenses.
- **Principles**:
    - Balance the flow, not the capacity.
    - Use buffers before bottlenecks.
    - Schedule based on constraints.

Steps in TOC-Based Scheduling (Drum-Buffer-Rope Method)

- **Drum**: The schedule of the bottleneck sets the pace for the entire system.
- **Buffer**: Time or inventory placed before the bottleneck to prevent idleness.
- **Rope**: Communication system to synchronize other resources with the bottleneck.

UNIT V

QUALITY MANAGEMENT

SYLLABUS

Definitions of quality, The Quality revolution, quality gurus; TQM philosophies; Quality management tools, certification and awards. Lean Management - philosophy, elements of JIT manufacturing, continuous improvement. Six sigma.

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Definitions of Quality

- **Quality** is commonly defined as the **degree to which a product or service meets or exceeds customer expectations**.
- **ISO Definition**: Quality is the "degree to which a set of inherent characteristics fulfills requirements."
- **Crosby's View**: "Conformance to requirements."
- **Deming's View**: Quality is about the consistent improvement of processes to meet customer needs.
- **Juran's View**: Fitness for use; focuses on product performance and freedom from deficiencies.

The Quality Revolution

- **Background**: Emerged post-WWII, especially in Japan, where focus shifted from quantity to quality.
- **Japanese Influence**: Adoption of statistical quality control and customer-focused practices led to high-quality products.
- **Global Spread**: By the 1980s, quality became a competitive advantage in the West.
- **Modern Focus**: Emphasis on customer satisfaction, continuous improvement, and strategic quality management.

Quality Gurus

1. W. Edwards Deming

Philosophy:

- Emphasized **quality improvement through statistical control**.
- Believed that **management is primarily responsible** for quality.
- Promoted **system thinking**, **continuous improvement**, and **long-term planning**.

Key Contributions:

- **14 Points for Management**: A guide for transforming business effectiveness.

- **System of Profound Knowledge**: Interplay between systems, variation, psychology, and knowledge.
- **PDCA Cycle (Plan-Do-Check-Act)**: A foundational model for continuous process improvement.
- Advocated for **elimination of quotas and numerical goals**, replacing them with leadership and process focus.

PDCA Cycle (Plan–Do–Check–Act)

Also known as the **Deming Cycle** or **Shewhart Cycle**, the PDCA model is a **four-step iterative process** used for continuous improvement of processes and products.

1. Plan

- **Define the problem** or opportunity for improvement.
- **Establish objectives** and identify the necessary processes and resources.
- **Analyze the current process** and gather relevant data.
- **Develop a plan** to make changes or test a hypothesis.

2. Do

- **Implement the plan** on a small scale (pilot test).
- **Train personnel** involved in the process.
- **Collect data** during implementation to monitor progress.

3. Check

- **Measure and analyze** the results against expected outcomes.
- **Evaluate effectiveness** of the changes.
- **Identify deviations** from the plan or unexpected issues.

4. Act

- **Standardize** the successful improvements.
- **Adjust the plan** if results were not as expected.
- **Begin the next PDCA cycle** for further improvements.

Purpose: Encourages a scientific approach to problem-solving and supports **continuous, incremental improvements**.

<u>Deming's 14 Points for Management</u>

Deming's 14 Points provide a **philosophical foundation for quality management** and organizational transformation.

1. Create constancy of purpose

- Focus on long-term planning and innovation to ensure survival and growth.

2. Adopt the new philosophy

- Embrace a culture of continuous improvement and no tolerance for poor quality.

3. Cease dependence on inspection

- Build quality into the process; don't rely solely on final inspections.

4. End the practice of awarding business on price tag alone

- Develop long-term relationships with suppliers based on quality and trust.

5. Improve constantly and forever the system of production and service

- Commit to ongoing quality and productivity enhancements.

6. Institute training on the job

- Equip workers with the skills they need to do the job right.

7. Institute leadership

- Managers should support employees in doing quality work, not just supervise.

8. Drive out fear

- Create an environment where people feel safe to express ideas or problems.

9. Break down barriers between departments

- Promote collaboration and teamwork across all functions.

10. Eliminate slogans, exhortations, and targets

- Focus on improving the system instead of placing blame on employees.

11. Eliminate numerical quotas for the workforce and numerical goals for management

- Encourage quality over quantity; quotas often result in poor workmanship.

12. Remove barriers that rob people of pride of workmanship

- Ensure fair treatment and provide the right tools and conditions.

13. Institute a vigorous program of education and self-improvement

- Encourage continuous learning and growth for all employees.

14. Put everyone in the company to work to accomplish the transformation

- Quality improvement must involve everyone, from top management to the floor workers.

Purpose: These points serve as a guide for transforming a company's culture and operations to focus on **quality, efficiency, and respect for people**.

2. Joseph M. Juran

Philosophy:

- Defined quality as **fitness for use**.
- Focused on the **human dimension** of quality management.
- Emphasized the role of **management leadership** in quality improvement.

Key Contributions:

- **Juran Trilogy**:
  - **Quality Planning**: Identify customers and their needs, develop products that meet those needs.
  - **Quality Control**: Monitor operations to meet performance standards.
  - **Quality Improvement**: Systematic approach to achieving breakthroughs in quality.
- Advocated the **Pareto Principle (80/20 rule)** to focus on vital few quality problems.

Famous Quote:

"Without a standard, there is no logical basis for making a decision or taking action."

3. Philip B. Crosby

Philosophy:

- Defined quality as **conformance to requirements**.
- Advocated **"Zero Defects"** as a realistic goal, not just a slogan.
- Emphasized **doing it right the first time (DIRFT)** to avoid costs of non-conformance.

Key Contributions:

- **Four Absolutes of Quality Management**:
  1. Quality is conformance to requirements.
  2. Quality prevention is the system.
  3. Zero Defects is the performance standard.
  4. Quality is measured by the price of non-conformance.
- Developed the concept of the **Cost of Quality (COQ)**:
  - Prevention Costs

- Appraisal Costs
- Internal Failure Costs
- External Failure Costs

Famous Quote:

"Quality is free. It's not a gift, but it is free. What costs money are the unquality things – all the actions that involve not doing jobs right the first time."

4. Kaoru Ishikawa
Philosophy:

- Focused on **quality across the entire organization**.
- Advocated **employee involvement** in quality at all levels.
- Emphasized the importance of **education and training in quality tools**.

Key Contributions:

- Developed the **Ishikawa (Fishbone) Diagram** to identify cause-and-effect relationships.
- Promoted the use of **Seven Basic Quality Tools** for problem-solving by all employees.
- Introduced the concept of **Quality Circles**—small groups of employees who meet regularly to discuss quality issues.
- Emphasized **internal customer concept**, treating the next process as a customer.

Famous Quote:

"Quality control starts and ends with education."

5. Genichi Taguchi
Philosophy:

- Focused on **designing quality into products from the beginning**.
- Believed in reducing **variation** and making products robust to environmental conditions.
- Viewed quality as **minimizing loss to society** rather than just meeting specifications.

Key Contributions:

- Developed the **Taguchi Loss Function**: Demonstrates how loss increases as a product deviates from the target value.
- Pioneered **Robust Design**: Product performance should not degrade under varying conditions.
- Introduced **Design of Experiments (DoE)**: Systematic testing of variables to optimize product and process design.

Famous Quote:

"Cost is more important than quality, but quality is the best way to reduce cost."

6. Armand V. Feigenbaum

Philosophy:

- Believed in **Total Quality Control** as a business strategy rather than a technical one.
- Stressed that **quality is everybody's job**, not just the responsibility of the quality department.

Key Contributions:

- Introduced the concept of **Total Quality Control (TQC)**: An integrated system where every function contributes to quality.
- Highlighted the **hidden plant**—work done to correct defects, which does not add value.
- Emphasized that **quality must be built into products and processes**, not inspected in.

Famous Quote:

"Quality is a way of managing the organization."

TQM Philosophies (Total Quality Management)

- **Definition**: A holistic approach focused on continuous improvement in all aspects of an organization.
- **Core Principles**:
  - Customer-focused organization
  - Total employee involvement
  - Process-centered approach
  - Integrated system
  - Strategic and systematic approach
  - Continuous improvement (Kaizen)
  - Fact-based decision making
  - Effective communication
- **Benefits**:
  - Improved quality and customer satisfaction
  - Reduced costs and waste
  - Employee motivation and involvement

Quality Management Tools

Seven Basic Quality Tools

1. Cause-and-Effect Diagram (Fishbone/Ishikawa Diagram)

Purpose:

To identify and visualize **root causes** of a specific problem.

Structure:

A "fishbone" with the **effect (problem)** at the head and **causes** as bones under categories such as:

- Man (people)
- Machine
- Method
- Material
- Measurement
- Environment

Example:

A manufacturer facing frequent product defects can use a fishbone diagram to explore whether it's due to **operator error**, **machine wear**, **poor materials**, or **flawed methods**.

2. Flowchart (Process Mapping)

Purpose:

To visually map out the **sequence of steps** in a process, identifying redundancies, delays, and non-value-adding activities.

Example:

A hospital maps the patient check-in process to identify bottlenecks and streamline paperwork and wait times.

3. Check Sheet

Purpose:

A structured form for **collecting and analyzing data** in real time at the location of data generation.

Example:

In a production line, workers use a check sheet to record each time a defect occurs, categorizing it (e.g., broken part, missing label, color mismatch).

4. Histogram

Purpose:

To show the **distribution and frequency** of data values, revealing patterns or variation.

Example:

A histogram can show how long customer service calls typically last—revealing if most fall within an acceptable range or if outliers are common.

5. Pareto Chart

Purpose:

To prioritize problems or causes using the **80/20 Rule**—a few causes are often responsible for most issues.

Example:

A retailer tracks customer complaints. A Pareto chart shows that 80% of complaints come from just 3 of 10 product lines, guiding corrective action.

6. Control Chart (Shewhart Chart)

Purpose:

Monitors **process variation** over time to determine if a process is stable and in control.

Components:

- Upper Control Limit (UCL)
- Lower Control Limit (LCL)
- Center Line (mean)

Example:

A bakery tracks cookie weights daily. If most weights fall within control limits, the process is stable. If a point goes outside, it signals a potential issue.

7. Scatter Diagram

Purpose:

To examine the **relationship between two variables** and identify correlations.

Example:

A manager plots machine temperature against the number of product defects. A positive trend may indicate that overheating leads to more defects.

Advanced Quality Tools

These are more complex and often used in Six Sigma, Total Quality Management (TQM), and ISO quality systems

1. Failure Mode and Effects Analysis (FMEA)
   Purpose:

A **proactive tool** used to identify potential **failure modes** in a product/process and assess their impact, causes, and likelihood.

   Steps:

- Identify potential failure modes
- Assess **Severity**, **Occurrence**, and **Detection**
- Calculate **Risk Priority Number (RPN)** = S × O × D
- Prioritize and mitigate high-risk items

   Example:

In car airbag design, FMEA could identify potential failure modes like non-deployment or late deployment, assess their risks, and improve design.

2. Statistical Process Control (SPC)
   Purpose:

Uses **statistics and control charts** to monitor, control, and improve processes.

   Tools Used:

- Control Charts
- Process Capability Analysis (Cp, Cpk)

   Example:

An electronics company uses SPC to ensure resistors are within resistance tolerance levels during production.

3. Design of Experiments (DOE)
   Purpose:

A structured method to determine **cause-and-effect relationships** between inputs and outputs, used to **optimize processes**.

   Example:

A paint manufacturer tests combinations of pigment concentration, drying time, and temperature to optimize color uniformity and drying speed.

4. Root Cause Analysis (RCA)

Purpose:

To dig deep into the **underlying cause** of a problem using systematic methods.

Common Techniques:

- 5 Whys
- Fishbone Diagram
- Fault Tree Analysis

Example:

A delivery company experiences repeated delays. Using 5 Whys:

- Why delayed? → Late truck.
- Why late truck? → Late departure.
- Why late departure? → Loading took too long.
- Root cause: Inefficient loading process.

5. Benchmarking

Purpose:

Comparing your process or product with **industry leaders or best practices** to identify improvement opportunities.

Example:

A hotel chain benchmarks its guest check-in process against the fastest competitor to reduce wait times.

6. Quality Function Deployment (QFD)

Purpose:

Translates **customer needs** into **technical requirements** throughout the product development cycle.

Tool:

House of Quality Matrix

Example:

A smartphone company uses QFD to convert customer needs (longer battery life, better camera) into engineering specifications.

Quality Certification and Awards

- **ISO 9001**: International standard for Quality Management Systems (QMS).
- **ISO 14001**: Focuses on Environmental Management Systems.
- **Six Sigma Certification**: Includes belts (Green, Black, Master Black) for proficiency in Six Sigma methods.
- **Malcolm Baldrige National Quality Award**: U.S. award recognizing performance excellence.
- **Deming Prize**: Japanese award for quality management excellence.
- **EFQM Excellence Award**: European award for organizational excellence.

Lean Management

Philosophy

- **Lean** focuses on creating more value with less work by eliminating waste.
- Originated from the **Toyota Production System (TPS)**.
- Emphasizes customer value, continuous improvement, and waste reduction.

Types of Waste (Muda)

- Overproduction
- Waiting
- Transportation
- Overprocessing
- Inventory
- Motion
- Defects
- Unused employee creativity

Type of Waste	Description	Example
Overproduction	Making more than needed	Producing 500 items when only 300 are ordered
Waiting	Idle time between steps	Workers waiting for machine repair
Transportation	Unneeded movement of goods	Moving parts between distant buildings
Overprocessing	Doing more than required	Excessively painting non-visible parts
Inventory	Excess stock not immediately needed	Overstock of raw materials
Motion	Unnecessary movement of workers	Reaching across the table repeatedly for tools
Defects	Rework or scrap due to errors	A batch of defective parts needing rework

Type of Waste	Description	Example
Unused Employee Creativity	Not using employees' ideas and problem-solving abilities	Workers not involved in process improvement

JIT Manufacturing

JIT Manufacturing is **a lean production philosophy** focused on producing **only what is needed, when it is needed, and in the amount needed**—with minimal inventory and waste. It aims to **reduce waste, improve quality, and increase efficiency** by tightly synchronizing production with demand.

Philosophy

- **Eliminate waste (muda)** by minimizing inventory and excess production.
- Produce goods **"just in time"** for the next step in the process or customer demand.
- Emphasize **continuous improvement** and **respect for people**.
- Encourage **flexible and responsive manufacturing systems**.
- Focus on **quality at the source**, preventing defects rather than inspecting after production.

Elements of JIT Manufacturing (Just-In-Time)

- **Pull System**: Production is based on actual demand, not forecasts.
- **Continuous Flow**: Smooth production flow with minimal interruptions.
- **Setup Time Reduction**: Faster changeovers to reduce batch sizes.
- **Total Productive Maintenance (TPM)**: Ensures equipment reliability.
- **Supplier Integration**: Long-term relationships with reliable suppliers.
- **Quality at the Source**: Defects are identified and resolved immediately.

Continuous Improvement (Kaizen)

Kaizen is a Japanese term meaning **"change for the better"** or **"continuous improvement."** It refers to an ongoing effort by individuals, teams, or organizations to **improve processes, products, or services incrementally** over time. Kaizen focuses on **small, gradual changes** rather than large-scale innovations.

Philosophy

- Improvement is **everyone's responsibility** — from top management to frontline workers.
- Small improvements **accumulate to significant results**.
- Emphasizes **eliminating waste** and increasing efficiency.
- Encourages **teamwork, personal discipline, and morale**.
- Promotes a culture of **open communication and suggestion**.

Key Principles of Kaizen

- **Continuous:** Improvement is never-ending.
- **Incremental:** Small, manageable changes.
- **Employee Involvement:** Everyone participates.
- **Standardization:** New improvements become the new standard.
- **Focus on Process:** Improve the process, not blame people.
- **Customer Focus:** Improvements should add value to the customer.

Kaizen Process / Cycle

1. **Identify an Opportunity**
   - Find a process or area where improvements can be made (e.g., reduce waste, improve quality).
2. **Analyze the Current Situation**
   - Gather data, map the process, and identify root causes of problems.
3. **Develop a Plan**
   - Brainstorm possible solutions and select the best one.
4. **Implement the Change**
   - Put the chosen improvement into practice on a small scale.
5. **Review the Results**
   - Measure performance, gather feedback, and verify effectiveness.
6. **Standardize the Improvement**
   - Update procedures, train staff, and document the new standard.
7. **Repeat the Cycle**
   - Look for new opportunities to improve further.

Tools Used in Kaizen

- **5S Methodology** (Sort, Set in order, Shine, Standardize, Sustain)
- **PDCA Cycle** (Plan-Do-Check-Act)
- **Cause-and-Effect Diagram**
- **Check Sheets**
- **Value Stream Mapping**
- **Root Cause Analysis (5 Whys)**

5S Methodology

5S is a **systematic approach to workplace organization and standardization** originating from Japan. It focuses on creating a clean, organized, and efficient workspace to improve productivity, safety, and quality. The term **5S** stands for five Japanese words, each beginning with 'S', representing steps for workplace improvement.

Japanese Term	English Meaning	Explanation
Seiri	Sort	Separate necessary items from unnecessary ones. Remove clutter.
Seiton	Set in Order	Organize and arrange items so they are easy to find and use.
Seiso	Shine	Clean the workspace and equipment regularly to maintain standards.
Seiketsu	Standardize	Establish standards for sorting, organizing, and cleaning.
Shitsuke	Sustain	Maintain discipline and make 5S a habit for continuous improvement.

Six Sigma

- **Definition**: A data-driven methodology for eliminating defects and reducing variation in processes.
- **Goal**: Achieve a defect rate of less than 3.4 defects per million opportunities (DPMO).
- **DMAIC Process**:
  - **Define**: Identify problem and customer requirements.
  - **Measure**: Collect data and determine current performance.
  - **Analyze**: Identify root causes of defects or inefficiencies.
  - **Improve**: Develop and implement solutions.
  - **Control**: Sustain improvements through monitoring and standardization.
- **DMADV Process**

  - **Define:** Identify project goals and customer requirements.
  - **Measure:** Collect data and determine key metrics.
  - **Analyze:** Evaluate design alternatives using data.
  - **Design:** Develop detailed design and prototypes.
  - **Verify:** Test and confirm the design meets requirements.

Key Roles in Six Sigma

- **Champion**: Senior manager responsible for project success.
- **Master Black Belt**: Expert trainer and mentor.
- **Black Belt**: Leads projects and trains Green Belts.
- **Green Belt**: Works on projects part-time under Black Belts.

Tools Used in Six Sigma

- Statistical analysis (ANOVA, regression)
- Process mapping
- FMEA
- Control charts
- Hypothesis testing

QUESTION BANK

DEPARTMENT OF MANAGEMENT STUDIES

SUBJECT : OPERATIONS MANAGEMENT

SEM / YEAR: 2nd Semester / 1st Year

UNIT – I - INTRODUCTION TO OPERATIONS MANAGEMENT			
SYLLABUS: Production – Meaning, Nature, Types. Operations Management – Nature, Importanc, functions, challenges, current priorities, recent trends; Operations Strategy – Strategic fit, framework; Supply Chain Management			
PART- A			
S. No	**QUESTIONS**	**BT LEVEL**	**COMPETENCE**
1	Define production.	Level 1	Remembering
2	Summarize the types of Production.	Level 2	Understanding
3	Identify the major components of a production system.	Level 3	Applying
4	What conclusion can you draw on "Operation management"?	Level 4	Analyzing
5	Discuss the objectives of operation management.	Level 5	Evaluating
6	Interpret the bottleneck in operations management.	Level 6	Creating
7	How would you describe the functions of Operations Management?	Level 1	Remembering
8	Outline the importance of Operations management. Relate the recent trends in Operations Management.	Level 2	Understanding
9	List the 5 steps in framework of operations strategy.	Level 3	Applying
10	What conclusions can you draw on Continuous production system?	Level 4	Analyzing
11	Determine the framework of operations strategy.	Level 5	Evaluating
12	What do you mean by Value Added Services?	Level 6	Creating
13	What is meant by Strategic Fit?	Level 1	Remembering
14	How would you show your understanding on developing a manufacturing strategy?	Level 2	Understanding
15	Examine the objectives of Supply chain management.	Level 3	Applying
16	Can you list the process of supply chain?	Level 4	Analysing
17	Can you explain "production function"?	Level 1	Remembering
18	How would you explain Supply Chain Management?	Level 2	Understanding
19	Tell the Cycle view of supply chain process.	Level 1	Remembering
20		Level 1	Remembering

PART- B			
S. No.	**QUESTIONS**	**BT LEVEL**	**COMPETENCE**
1	What is Production? Explain the types of Production system.	Level 1	Remembering
2	Summarize the nature of Production in detail.	Level 2	Understanding
3	Write the nature and importance of operations management.	Level 3	Applying
4	List the scope and objectives of operations management.	Level 4	Analysing
5	Discuss the role of operations in strategic management.	Level 5	Evaluating
6	How could you determine the objectives and historical development of operations management?	Level 6	Creating
7	How would you describe the functions of Operations Management?	Level 1	Remembering
8	Demonstrate the recent trends in production and operations management.	Level 2	Understanding
9	Identify the challenges and current priorities for Operations Management.	Level 3	Applying
10	What inference can you make in Strategy Fit along with framework of operations strategy?	Level 4	Analysing
11	What is SCM? Explain flow in SCM and process view of supply chain in detail.	Level 1	Remembering
12	Outline the objectives and Functions of supply chain management.	Level 2	Understanding
13	In today's global environment scenario the nature of operations management in any country is similar to International Operations Management – Comment.	Level 4	Analysing
14	How would you elaborate the concept of SCM?	Level 1	Remembering

	PART - C
S.No.	**Questions**
1	Construct the following : • Customer order cycle • Replenishment cycle • Manufacturing cycle • Procurement cycle • Pull concept • Push concept
2	Assume you are running a Detergent manufacturing company. Design a supply chain network for effective distribution of Detergents in the markets.
3	How would you show your understanding on operations strategy in manufacturing and services?
4	Can you give a detailed outline of the Supply Chain Process in FMCG industry?

UNIT - II FORECASTING, CAPACITY ANF FACILITY DESIGN			
SYLLABUS: Demand Forecasting – Need, Types, Objectives and Steps. Overview of Qualitative and Quantitative methods. Capacity Planning – Long range, Types, Developing capacity alternatives. Overview of sales and operations planning. Overview of MRP, MRP II and ERP. Facility Location – Models, Factors affecting facility location, Steps in Selection, Location Models. Facility Layout – Principles, Types.			
PART - A			
S. No.	**QUESTIONS**	**BT LEVEL**	**COMPETENCE**
1	Define Demand Forecasting.	Level 1	Remembring
2	Classify the need of Demand Forecasting.	Level 2	Understanding
3	Identify the objectives of Demand Forecasting.	Level 3	Applying
4	List the methods in Qualitative Forecasting?	Level 4	Analysing
5	Can you list the characteristics for demand forecasting?	Level 5	Evaluating
6	What is your opinion of Capacity planning?	Level 6	Creating
7	What is aggregate planning?	Level 1	Remembering
8	Infer the factors affecting Capacity Planning.	Level 2	Understanding
9	Demonstrate the concept of Capacity Planning procss.	Level 3	Applying
10	Compare the difference between RCCP an CRP.	Level 4	Analysing
11	What conclusions can you draw on Material Requirement Planning?	Level 5	Evaluating
12	How would you prioritize the facts in focus forecasting?	Level 6	Creating
13	How would you explain Enterrise Resource Planning?	Level 1	Remembering
14	Summarize the steps in Location Planning.	Level 2	Understanding
15	How would you show your understanding of Cellular Manufacturing?	Level 3	Applying
16	What are the features on product and process layout?	Level 4	Analyzing
17	Define MRP II.	Level 1	Remembering
18	Compare between MRP I and MRP II.	Level 2	Understanding
19	Define product structure tree.	Level 1	Remembering
20	Choose the relevant factors affecting facility location.	Level 1	Remembering

<table>
<tr><th>S. No.</th><th>QUESTIONS</th><th>BT LEVEL</th><th>COMPETENCE</th></tr>
<tr><td>1</td><td>Illustrate the various methods of Demand Forecasting.</td><td>Level 1</td><td>Remembering</td></tr>
<tr><td>2</td><td>How would you summarize the need, types of Demand Forecasting</td><td>Level 2</td><td>Understanding</td></tr>
<tr><td>3</td><td>How would you show your understanding of the Objectives of Demand Forecasting & Steps of forecasting?</td><td>Level 3</td><td>Applying</td></tr>
<tr><td>4</td><td>a.) Examine the trend of following by using Semi-Average; Estimate the sales of the year 2020.
<table>
<tr><td>Year</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td><td>2015</td><td>2016</td><td>2017</td><td>2018</td><td>2019</td></tr>
<tr><td>Sales (Rs.in lakhs)</td><td>18</td><td>24</td><td>26</td><td>28</td><td>33</td><td>36</td><td>40</td><td>44</td><td>48</td></tr>
</table>
b.) Examine the trend of following by using Semi-Average. Estimate the sales of the year 2017
<table>
<tr><td>Year</td><td>2011</td><td>2012</td><td>2013</td><td>2014</td><td>2015</td><td>2016</td></tr>
<tr><td>Sales</td><td>10</td><td>12</td><td>11</td><td>16</td><td>15</td><td>20</td></tr>
</table></td><td>Level 4</td><td>Analysing</td></tr>
<tr><td>5</td><td>From the following data, calculate 4 year moving average.
<table>
<tr><td>Year</td><td>I</td><td>II</td><td>III</td><td>IV</td><td>V</td><td>VI</td><td>VII</td><td>VIII</td><td>IX</td><td>X</td></tr>
<tr><td>Output</td><td>20</td><td>21</td><td>23</td><td>22</td><td>25</td><td>24</td><td>27</td><td>26</td><td>28</td><td>30</td></tr>
</table></td><td>Level 5</td><td>Evaluating</td></tr>
<tr><td>6</td><td>How would you compare the ideas in capacity planning with distinct levels? Also explain the factor influencing Capacity planning?</td><td>Level 6</td><td>Creating</td></tr>
<tr><td>7</td><td>Recognize the process of Capacity planning.</td><td>Level 1</td><td>Remembering</td></tr>
<tr><td>8</td><td>A company has to decide on the location of a new plant. It has narrowed down the choice to 3 locations A,B and C data in respect of which is furnished below:
<table>
<tr><th rowspan="2">Data</th><th colspan="3">Locations</th></tr>
<tr><th>A (Rupees)</th><th>B(Rupees)</th><th>C (Rupees)</th></tr>
<tr><td>Wages and Salaries</td><td>20000</td><td>20000</td><td>20000</td></tr>
<tr><td>Power and Water Expenses</td><td>20000</td><td>30000</td><td>25000</td></tr>
<tr><td>Raw Materials and Other Supplies</td><td>80000</td><td>75000</td><td>60000</td></tr>
<tr><td>Total Initial investment</td><td>200000</td><td>300000</td><td>250000</td></tr>
<tr><td>Distribution Expenses</td><td>50000</td><td>40000</td><td>60000</td></tr>
</table></td><td>Level 2</td><td>Understanding</td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td>Miscellaneous Expenses</td><td>40000</td><td>25000</td><td>30000</td></tr>
<tr><td>Expected Sales Per Year</td><td>225000</td><td>250000</td><td>225000</td></tr>
</table>
Use a suitable criterion and advise the company on the best choice.
</td><td></td><td></td></tr>
<tr><td>9</td><td>How would you show your utilization of the sales and operations planning cycle?</td><td>Level 3</td><td>Applying</td></tr>
<tr><td>10</td><td>Analyse the concept of Facility layout principles.</td><td>Level 4</td><td>Analysing</td></tr>
<tr><td>11</td><td>How would you explain the steps in Location Selection & Discuss the factors affecting facility location?</td><td>Level 1</td><td>Remembring</td></tr>
<tr><td>12</td><td>Demonstrate the following
MRP I (5 Marks)
MRP II (5 Marks)
ERP (3 Marks)</td><td>Level 2</td><td>Uderstanding</td></tr>
<tr><td>13</td><td>
a. The firm Velu Naachiyar India Ltd. wants to start a Washing machine manufacturing unit in South Tamil Nadu and has to decide on one of the two options narrowed down by its Top level management. Based on the following factors and ratings, you have to advice Velu Naachiyar India Ltd., on selection of Location.
<table>
<tr><th rowspan="2">S. No.</th><th rowspan="2">Details of Factors</th><th rowspan="2">Factor Rating (1 to 5 Scale)</th><th colspan="2">Location Rating (Scale 1 to 10)</th></tr>
<tr><th>Location A</th><th>Location B</th></tr>
<tr><td>1</td><td>Power, ability and costs</td><td>3</td><td>6</td><td>4</td></tr>
<tr><td>2</td><td></td><td>1</td><td>1</td><td>2</td></tr>
<tr><td>3</td><td></td><td>3</td><td>5</td><td>4</td></tr>
<tr><td>4</td><td>Desire of Top level officials</td><td>3</td><td>2</td><td>4</td></tr>
<tr><td>5</td><td></td><td>5</td><td>8</td><td>9</td></tr>
<tr><td>6</td><td>Environmental Factors</td><td>4</td><td>6</td><td>5</td></tr>
<tr><td>7</td><td>Civil amenities</td><td>2</td><td>9</td><td>8</td></tr>
<tr><td>8</td><td>Availability, willingness of executive cadre</td><td>5</td><td>7</td><td>6</td></tr>
<tr><td></td><td>Nearness to market centers</td><td></td><td></td><td></td></tr>
<tr><td></td><td>Transportation, storage costs</td><td></td><td></td><td></td></tr>
<tr><td></td><td>Labor skill, wages, unionism</td><td></td><td></td><td></td></tr>
</table>
b. Kuyili Group of Companies is evaluating 4 locations for a new plant and has weighted the relevant scores as given below. Scores have been assigned with higher values indicative of preferred conditions. Using these scores, develop a qualitative factor comparison for the four locations.
<table>
<tr><th>Relevant factors</th><th>Assigned Weight</th><th>A</th><th>B</th><th>C</th><th>D</th></tr>
<tr><td>Markets</td><td>0.10</td><td>70</td><td>90</td><td>80</td><td>50</td></tr>
<tr><td>Cost of living</td><td>0.05</td><td>80</td><td>70</td><td>40</td><td>80</td></tr>
<tr><td>Raw material</td><td>0.25</td><td>70</td><td>80</td><td>80</td><td>60</td></tr>
</table>
</td><td>Level 4</td><td>Analysing</td></tr>
</table>

	supply							
	Manufacturing cost	0.35	50	40	60	30		
	Labour availability	0.20	60	70	60	50		
	Environment	0.05	50	60	70	90		
	Total	1.00						
14	Elaborate the basic types of Facility Layouts.						Level 1	Remembering

S.No	PART - C Questions
1	Potential locations A, B and C have the cost structures shown for producing a product expected to sell at Rs. 100 per Unit. Find out the most economical location for which each of the locations would be most economical. Location Fixed Cost /Year Variable Cost /Unit A 25000 50 B 50000 25 C 80000 15
2	The table below gives the actual demand in units for the past 10-month period. Compute a weighted 3 Month Moving Average where the weights ar highest for the latest months and descend the order of 3, 2, 1. Month 1 2 3 4 5 6 7 8 9 10 Demand 100 105 108 110 112 114 120 130 128 140
3	A department works on 8 hours shift, 250 ays a year and has the usage data of a machine as given below: Determine the number of machines required. **Product** / **Annual Demnd (units)** / **Processing Time (Std in Hours)** **X** 250 3 **Y** 350 4 **Z** 425 5
4	Karikaalan Exports limited is a major garment export house based at Sivagangai. The sales figures (in 1000units) of a particular garment during the past 20 weeks are given in table below: (i) Calculate the three week moving average 22 forecast for the given 20 weeks and also forecast the demand for 21st week. (5Marks) (ii) Calculate the eighted moving average forecast for the given 20 weeks with the weights being W1 =1, W2 =2 and W3 =3. And also forecast the demand for 21st week.(5Marks) (iii)Find the simple exponential smoothing forecast for all the 20 weeks and also forecast the demand for 21st week. Assume α = 0.2 and F1 =21. (5Marks) **Week** / **Demand** 1 21 2 24 3 18 4 22 5 27 6 23 **Week** / **Demand** 11 19 12 22 13 26 14 24 15 17 16 21

1	Explain nature and importance of Inventory management.	Level 1	Remembering
2	Explain the classification of inventory.	Level 2	Understanding
3	Identify the inventory control techniques.	Level 3	Applying
4	What are the features in selective inventory control?	Level 4	Analysing
5	Discuss the objectives, functions of purchasing?	Level 5	Evaluating
6	Prioritize the Importance of budgeting and control in inventory process. Describe the procedure in purchasing.	Level 6	Creating
7	How would you summarize the policies and procedure in purchasing?	Level 1	Remembering
8	How would you Organize the various purchasing policies?	Level 2	Understanding
9	Can you identify the different techniques involved in vendor rating?	Level 3	Applying
10		Level 4	Analysing
11	a) Explain in detail the procedure to carry out Value Analysis (8Marks) b) List the Pros and Cons of Value Analysis (5Marks)	Level 1	Remembering
12	a) Give a detailed outline on layout of stores (5Marks) b) Explain the classification and coding of stores layout (8Marks)	Level 2	Understanding
13	a) What inference can you make in Store management? (3 Marks) b) Can you list the objectives and procedure of Store management? (10 Marks)	Level 4	Analysing
14	Illustrate the elements, benefits and limitations of JIT with real world example.	Level 1	Remembering

	PART - C
S. No.	**Questions**
1	As a purchase manager of Thirunelveli Group of companies, what factors do you consider to evaluate the vendors?
2	The following details are available in respect of a firm: i. Inventory requirement per year = 6000 Units ii. Cost per Unit (Other than Carrying and Ordering Cost) = Rs 5 iii. Carrying cost per unit for One Year = Re. 1 iv. Cost of Placing each Order = Rs 60 v. Alternative Order Sizes (Units) 6000, 3000, 2000, 1000, 600 and 200. Determine the Economic Ordering Quantity.

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 10200

M.B.A. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Second Semester

BA 4204 – OPERATIONS MANAGEMENT

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is an expert system?
2. What is mass customization?
3. Give any two examples for long range capacity planning in heavy industries.
4. What is make or buy decision?
5. Define a product type layout.
6. What is modular design?
7. What is Naive forecast?
8. What is Synchronous Manufacturing?
9. What are the four costs of quality?
10. Define six sigma.

PART B — (5 × 13 = 65 marks)

11. (a) Describe the characteristics of services and manufactured products. List and briefly describe five differences between services and manufacturing. Provide examples to illustrate your points.

Or

(b) Describe the recent Word class Manufacturing technology practices that enhance production and productivity in the Indian Manufacturing organizations.

12. (a) A manager has received an analysis of several cities being considered for a new order fulfillment center (warehouse) for Shop at Home Network. The scores (scale is 10 points = best) are contained in the table below.

(i) If the manager weights the factors equally, how would the locations be ranked? (7)

(ii) If transportation costs and operating costs are given weights that are double the weights of the others, should the locations be ranked differently? (6)

	Location			
Factor	w	x	y	z
Business services	7	9	5	4
Community services	5	7	6	7
Real estate cost	7	3	8	6
Construction costs	8	6	6	5
Operating costs	5	4	7	6
Business taxes	6	9	6	4
Transportation costs	8	6	7	8

Or

(b) Define theoretical and rated capacity and list any for factors that affect a company's capacity. Indicate how each factor impacts rated capacity.

13. (a) In detail list the phases of the product development process and explain the actions which takes place in each phase.

Or

(b) Identify the fundamental layout strategies. Describe the use of each one very briefly.

14. (a) In detail explain about any three qualitative forecasting techniques and compare their strengths and weaknesses.

Or

(b) (i) What are the assumptions of the EOQ model? (6)

(ii) Identify the typical components that constitute inventory holding or carrying costs. (7)

15. (a) Compare and contrast Deming's, Juran's, and Crosby's contributions to quality management. Also bring out the similarities and differences between their perspectives?

Or

(b) Explain the different approaches to Six sigma. Explain the steps involved in DMAIC and DMADV.

PART C — (1 × 15 = 15 marks)

16. (a) You have been hired as an expert by an Electric Vehicle manufacturer who is going to setup the production facility in India. Your role is to suggest a suitable guidelines regarding the strategic sourcing of components and raw materials. Present your findings with respect to the factors to be considered regarding the make or buy decisions for optimal sourcing of components and raw materials.

Or

(b) In detail explain the varied elements of JIT manufacturing in the present day operations management perspective.

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Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 30085

M.B.A. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

Second Semester

BA 4204 – OPERATIONS MANAGEMENT

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the operations strategies?
2. Define operations management.
3. What is the need of facility location?
4. Why is the make-or-buy decision considered strategic?
5. What are the four types of facility layouts?
6. List out the five stages of product development process.
7. What is operational scheduling?
8. What is inventory planning in operations management?
9. Define quality.
10. What is Six Sigma?

PART B — (5 × 13 = 65 marks)

11. (a) What are the principles of operations management? Explain.

Or

(b) Elaborate the scope of operations management.

12. (a) Discuss the different factors influencing facility location.

Or

(b) State the factors which should be kept in mind while deciding upon a suitable type of plant lay out.

13. (a) Enumerate the stages of product design.

Or

(b) State the objectives of service facility layout.

14. (a) Discuss the various steps involved in demand forecasting.

Or

(b) Enumerate the different techniques involved in inventory control.

15. (a) What are the 14 reasons to do a Six Sigma Certification?

Or

(b) Distinguish between total quality management and Six Sigma.

PART C — (1 × 15 = 15 marks)

16. (a) Motorola's Six-Sigma Approach to Total Quality Renews the firm

Motorola was founded in 1928 by Paul Galvin who led the company until 1959. After his death, his son Robert Galvin was chief executive officer from 1959 until 1986. His son Christopher Galvin became president of Motorola in 1993.

The company had over 1,20,000 employees and about $17 billion in sales in 1993 out which international sales accounted for about 52 percent. All of its products and services were in the area of electronics, including mobile radio and paging systems, cellular phones and systems, space communications and computers.

In such an industry new product development and adaptability to rapidly changing technology are critical to survival. How is a company the size of Motorola continually renewed?

In the early 1980s, Motorola stressed quality improvement with a goal of a tenfold improvement in a quality levels in five years. In 1987 Motorola adopted a formal Total Quality initiative name as "Six Sigma". "Six Sigma" refers to a defect rate of no more than 3.4 per million opportunities for error. In 1988, its Total Quantity process won Motorola one of the first Malcolm Baldrige National Quality Awards. The six steps in Motorola's Six-Sigma process are as follows :

- Identify the work you do (Your "Product")
- Identify who your work is for (your "Customer")
- What do you need to do your work, and from whom (your "supplier")
- Map the process
- Mistake-proofs the process and eliminates delays.
- Establish quality and cycle-time measurement and improvement goals.

The Six-Sigma process was implemented in the context of the Motorola culture. Motorola's fundamental objective, key beliefs, goals and initiatives were printed on a small card for employee to cany and have been translated into 11 languages for Motorola's world-wide operations. The contents of the card were as follows :

Side 1 : Our fundamental objective : (Everyone's over riding responsibility

- "Total Customer Satisfaction"

Side 2 : Key beliefs - how we will always act

Constant Respect for people

Uncompromising Integrity.

Key Goals : What we must accomplish?

Best-in-Class

People

Marketing

Technology

Product ; Software, Hardware and Systems

Manufacturing

Service

Increased Global Market Share

Superior Financial Results

Key Initiatives:

Six-Sigma Quality

Total Cycle Time Reproduction

Product, Manufacturing and Environmental Leadership

Profit Improvement

Empowerment for all, in a Participative, Cooperative and Creative Workplace.

Discussion Questions :

(i) What does "empowerment for all" mean in such a large organization with over 1,20,000 employees?

(ii) What is the role of teams in a process such as Six Sigma?

Or

(b) The Case of a U.S. Company with a Japanese TQC Programme :

In 1974, a division of Motorola was acquired by Matsushita Electric Industrial Company. It employed 1200 people in Franklin Park to produce colour television receivers and microwave ovens. Five years after the change over, in-process defects had dropped from 1.4 to 0.07 defects per set and productivity had jumped almost 30 percent. The labour required to produce a colour television receiver was cut in half These gains were achieved by blending new equipment, technology, training and managerial practices to revitalize an already skilled labour force.

Equipment: Automatic equipment developed in Japan for Chassis assembly was used. Design changes reduced the number of required workers by 26 percent. Equipment and design engineers worked together to improve "producibility" making quality products easier to manufacture.

Technology: New assembly lines allowed workers to control their work flow individually. In place of continuous, convey our paced line, operators were given foot levers to detour work to their station and to forward finished pieced to the next work stations. Closed-circuit television systems were installed to broadcast quality information to workers on the production line.

Training: The important of quality was continually emphasized, placing responsibility on production workers, not inspectors. End-product inspection teams were replaced by a few in-process inspectors who moved from one assembly line to another carrying out sampling inspection. New employees are trained both in the class room and on-the-job, upto 5 days of each, during which they learn about quality expectations, are judged on whether they can do the work adequately and see whether they like the work conditions.

Managerial Practice: Once a week all work stops for 10 to 15 minutes while supervisors communicate with their subordinates. A supervisor typically communicates with 45 workers about quality, productivity, absenteeism, scrap and any other subjects that might come up. If the supervisors cannot answer a question, they make a note of it and come prepared with an answer in the next meeting.

Every six month, manufacturing and quality control people meet to set quality goals for different areas. Bar charts are kept to signal which areas are above, near or below their targets. Special effort is concentrated on a particular line, called the model line, to improve its performance. Workers on that line and support groups meet once a week to explore progress. Reasons for successes in the model line are identified and adopted to fit other lines.

A quality emphasis month is declared twice a year. Awareness is aroused by slogan and posters competitions, cross word puzzles with quality terms and suggestion contests. Winners are entertained at a felicitation party and given a modest reward.

The underlying purpose of all activities is to create an environment that will be conducive to cooperation and encouraging people together to identify problems and offer suggestions to solve them.

Discussion Questions :

(i) Discuss the relative contribution and quality improvement of the engineering/technology investment with the human resource management changes made at the Motorola plant.

(ii) Quality control circles were not established at the plant by the Matsushita Company. Suggest reason that circles were not used, even though they enjoy great success in Japan.

Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 90079

M.B.A. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Second Semester

BA 4204 – OPERATIONS MANAGEMENT

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the meaning of operations Management?
2. List out the major components of production system.
3. Define strategic fit.
4. Write a short note on capacity planning.
5. What do you mean by product design?
6. Give a short note on competitive priorities.
7. What is meant by demand forecasting?
8. Why is operations scheduling important?
9. Briefly explain the overview of JIT.
10. Define lean management.

PART B — (5 × 13 = 65 marks)

11. (a) Discuss the scope of production and operation management. (13)

Or

(b) Explain in detail about the challenges and current priorities in operations management. (13)

12. (a) Describe the steps involved in selecting the facility location. (13)

Or

(b) Enumerate the various tools for capacity planning in detail. (13)

13. (a) Explain the factors influencing the product design. (13)

Or

(b) Discuss the steps involved in process planning. (13)

14. (a) Briefly explain in detail the methods of demand forecasting with suitable examples. (13)

Or

(b) Alpha Industry needs Rs. 15,000 units / year of a automobile component, which will be used in its main product. The ordering cost is Rs. 125 per order and the carrying cost per unit year is 20% of the purchase price per unit, which is Rs. 75. Find

(i) EOQ (8)

(ii) Number of orders per year. (3)

(iii) Time between successive orders. (2)

15. (a) Explain the Deming's 14 principles in detail. (13)

Or

(b) Discuss in brief the new quality management tools. (13)

PART C — (1 × 15 = 15 marks)

16. (a) Write an essay about the production planning and prepare the production planning for automobile manufacturing industry. (15)

Or

(b) The demand for a certain perfume bottle at a department store is 30 per day. The store opens 250 days a year. The ordering cost from the manufacturer is estimated at $6 per order and the yearly holding cost at $3 per bottle. Assume a simple EOQ (Economic Order Quantity) inventory model. Round your answers to zero decimal digits.

(i) If the manager decided to order 300 bottles every time an order is made, the length of an inventory order cycle is? (8)

(ii) If the store manager decided to order 200 bottles each time an order is made, then the manager will incur an increase in the total annual holding and ordering inventory cost of? (7)