NEERAJ®

MMPC-9

Management of Machines and Materials

Chapter Wise Reference Book
Including Many Solved Sample Papers

Based on

I.G.N.O.U.

& Various Central, State & Other Open Universities

By: Manisha Chattopadhyay, M.B.A

NEERAJ PUBLICATIONS
(Publishers of Educational Books)

Mob.: 8510009872, 8510009878 E-mail: info@neerajbooks.com
Website: www.neerajbooks.com

MRP ₹ 300/-

Content

MANAGEMENT OF MACHINES AND MATERIALS

S.No.	Chapterwise Reference Book	Page

■■

Sample Preview of the Solved Sample Question Papers

Published by:

NEERAJ PUBLICATIONS

www.neerajbooks.com

QUESTION PAPER

June – 2024

(Solved)

MANAGEMENT OF MACHINES AND MATERIALS

MMPC-9

Time: 3 Hours] ***[Maximum Marks: 100***

Note: *(i) This question paper consists of seven questions. (ii) Attempt any five questions. (iii) Each question carries equal marks.*

Q. 1. What do you understand by intermittent flow process? Explain its characteristics also.

Ans. Ref.: See Chapter-3, Page No. 17, 'Intermittent Flow Process'.

Also Add: Characteristics of Intermittent Flow Process:

1. Production in Small Lots or Batches: Intermittent flow processes usually involve the production of goods in small quantities, batches, or specific orders. The production schedule varies based on customer demands or specific orders rather than a continuous, uniform production process.

2. High Flexibility: This process allows for a high level of flexibility in terms of product variety. The same equipment and workforce can be used to produce different types of products, making it suitable for custom or varied production. Changes in production setups are common and expected.

3. Job Shop Environment: Intermittent flow processes are often found in job shop environments where there are various machines, equipment, and skilled labour capable of handling a wide range of tasks. Each job may require different equipment setups, tools, or techniques.

4. Complex Scheduling and Planning: Since the process is not continuous, production planning and scheduling are more complex compared to continuous processes. Each batch may have a different timeline and priority, making it necessary to have efficient production planning systems in place.

5. Custom or Variable Production: Products made in an intermittent flow process are typically tailored to customer specifications. For example, in industries like printing, furniture manufacturing, or custom metalwork, products are not made on an assembly line, but are customized per order, and each may differ from the next.

6. Work-in-Progress (WIP): Since the production occurs in batches and there may be frequent interruptions or changes in the process, work-in-progress (WIP) inventory tends to accumulate. This is due to waiting times for different processes or stages of production.

7. Skilled Labor Requirement: The nature of the intermittent flow process often requires skilled workers who are capable of handling a variety of tasks and equipment. Workers need to adapt to frequent changes in the product design or production process.

8. Use of General-Purpose Machines: In this process, companies tend to use general-purpose machines rather than specialized equipment. These machines are adaptable to different types of production, making it easier to switch between various tasks and product designs.

Q. 2. Define batch production. Also, write its advantages and disadvantages.

Ans. Ref.: See Chapter-10, Page No. 71, 'Introduction' and 'Features of Batch Production'.

Q. 3. "Long-term and medium-term forecast of the demand of an output are made by using various casual forecasting methods." Explain the various methods for predicting future capacity requirements.

Ans. Ref.: See Chapter-6, Page No. 41, 'Predicting Future Capacity Requirements'.

Q. 4. What do you understand by the term codification? Explain the various objectives of a codification system.

Ans. Ref.: See Chapter-19, Page No. 145, 'Codification'.

Also Add: Objectives of a Codification System:

1. Simplification and Standardization: The primary objective of codification is to simplify and standardize the classification of objects, data, or information. This ensures that every item or piece of information is consistently classified under a specific code, avoiding ambiguity or confusion.

2. Easy Identification and Retrieval: Codification allows for the quick and easy identification of materials, items, or data. By assigning unique codes, one can retrieve specific items without searching through large volumes of data, making it a critical tool in inventory systems and data management.

3. Elimination of Duplication: A well-structured codification system ensures that each item or piece of data is assigned a unique code. This prevents duplication and redundancy, which helps in minimizing errors and improving accuracy, especially in inventory and data storage.

4. Efficiency in Communication: Codification improves communication within and across departments or organizations by providing a clear and concise method to reference specific items or information. This avoids misunderstandings and streamlines the communication process.

5. Facilitation of Record-keeping and Auditing: Codification helps maintain systematic and organized records, which makes auditing and monitoring easier. A well-coded system ensures that records are traceable, transparent, and consistent, which is important for accountability and compliance.

6. Facilitating Automation and Integration: Codification enables the integration of systems and automation of processes by using standard codes that are machine-readable and interoperable. This is especially relevant in sectors such as logistics, supply chain management, and IT systems where automatic tracking and identification are essential.

Q. 5. Discuss the complementary relationship of waste management and resource management.

Ans. Ref.: See Chapter-20, Page No. 150, 'Introduction', 'Complementarity of Waste Management and Resource Management' and Page No. 151, 'The Functional Classification of Waste Management'.

Q. 6. Under what circumstances would you use PERT as opposed to CPM in project management?

Ans. Ref.: See Chapter-12, Page No. 87, 'Critical Path Method (CPM)' and 'Programme Evaluation and Review Technique (PERT)', Page No. 88, Q. No. 1.

Also Add: In project management, PERT (Program Evaluation Review Technique) and CPM (Critical Path Method) are both scheduling techniques used to plan, schedule, and control complex projects. However, the choice of whether to use PERT or CPM depends on certain circumstances and project characteristics. Here's when each is most appropriate:

1. Use PERT When:

- **Project activities are uncertain or highly variable:** PERT is more suited for projects where the duration of tasks is not well known and is likely to vary. It focuses on probabilistic time estimates by using three different time estimates for each activity:
- **Optimistic time (O):** The shortest time in which the task can be completed.
- **Most likely time (M):** The most probable time required.
- **Pessimistic time (P):** The longest time the task could take.

This is particularly useful for research and development (R&D) projects, product innovation, or projects where there is little prior experience or data to accurately predict task durations.

- **You want to focus on time estimates and risk management:** PERT helps in identifying tasks that are more uncertain or risky by providing a range of time estimates. It helps in understanding the impact of uncertainty on project completion time, making it great for risk analysis.
- **There are no well-defined costs or resources associated with activities:** PERT does not emphasize resource or cost estimates. It is more time-centric, useful in projects where the primary goal is to manage schedules and understand timing variability, rather than resource management.
- **Flexibility is key:** If the project requires flexibility in handling delays or adapting to changes in activity durations, PERT is more adaptable due to its probabilistic nature.

Example projects: New product development, space exploration projects, scientific research.

2. Use CPM When:

- **Activity durations are well-known and deterministic:** CPM is more appropriate when

Sample Preview of The Chapter

Published by:

NEERAJ PUBLICATIONS

www.neerajbooks.com

MANAGEMENT OF MACHINES AND MATERIALS

OPERATIONS MANAGEMENT: AN OVERVIEW

Operations Management: An Overview

1

INTRODUCTION

All organisations earn their revenue by offering products and/or services for sale. The products, and/or services, that are offered for sale is the output of the organisations. For making the output an organisation requires certain inputs or raw materials and a conversion process to transform the input into the output. The management of the conversion process, which can include transformation, transportation, storing and inspection of inputs, is called operations management. Earlier the subject was called Productions Management. The name was later changed to Operations Management to encompass the study of management of conversion process in the rapidly growing services sector.

CHAPTER AT A GLANCE

SYSTEMS CONCEPTS IN OPERATIONS MANAGEMENT

A system is a collection of objects which are interrelated and interdependent. A system within a bigger system is called a sub-system. A system draws inputs from the environment and converts them into outputs which are again let out in the environment. An organisation can also be viewed as a system as it takes input from the environment in the form of raw materials, labour and capital and converts them into finished products to be sold to consumers. The output of one organisation forms the input of another organisation or household and that is the way a particular organisation is linked with other organisations or households in its environment. Hence, if we take a larger view, an organisation's environment is the system and the organisation is a sub-system. If we take a micro view, the departments within an organisation namely–finance, marketing, MIS, materials, HRD and operations can be all viewed as subsystems of the organisation system. The operations system draws inputs from other departments to convert them into outputs which when converted to money through sales, serves as inputs for all other departments. Inputs can be tangible such as labour or capital or intangible such as information or knowledge. A subsystem influences as well as is influenced by the activities of other subsystems and often functions of subsystems may overlap.

OBJECTIVES IN OPERATIONS MANAGEMENT

The objectives of the operations management systems flow from the corporate objectives and strategies. If the organisation adopts a low cost strategy then the operations department will have to aim for achieving a given output with minimum input. On the other hand if the organisation aims for a differentiation strategy then operations system should aim for flexibility. Whatever the corporate strategy, increasing the productivity, that is the output to input ratio, is always the concern of the operations department. Usually the output is fixed periodically by using forecasting techniques, hence, productivity can be increased by making best uses of inputs or resources

by maximum utilisation of capacity. Efficiency is doing correctly whereas effectiveness is doing the correct things. Increasing the effectiveness that is identifying how things can be done in a better way and implementing them, is also one of the objectives of the firm. Care should be taken that efficiency is increased for doing the correct things and not the incorrect ones. Efficiency should not be increased at the cost of effectiveness. Other objectives of operations can be achieved 100% conformance to predecided standards of quality or raising the conformance level, reducing the time required for the conversion. All these are performance objectives of the organisation. The organisation may also adopt cost control objectives by minimising the explicit and implicit costs.

OPERATIONS MANAGEMENT DECISIONS

Operations management decisions can be discussed in several different ways, which are as follows:

Periodic and Continual Decisions: Periodic decisions are concerned with decisions which have to be taken periodically. Such decisions can pertain to selection, design and updation. Decisions pertaining to selection can be regarding the products, processes, equipments, location, layout, workforce. Decisions pertaining to design can be regarding the design of products, machineries and equipments, jobs, methods, remuneration system, operating and control systems and formulation of various systems and procedures. Decisions pertaining to updation would include modifying the system according to the changes in the environment and on the basis of feedback.

Continual decisions are decisions which have to be taken on a continuous basis. Decisions pertaining to setting of targets, schedules, sequences, maintenance and control of inventory, quality and production, are all covered under continual decisions.

Planning, Organising and Controlling Decisions: Operations management decisions can also be viewed as consisting of planning, organising and controlling decisions. Planning decisions would pertain to the planning of the conversion system and utilisation of the conversion system. Once the conversion process and its utilisation has been planned the need is to take several organising decisions pertaining to staff, work design, standard of production, remuneration, sequencing and structuring of operations etc. Controlling decisions would pertain to control over quantity, quality, time, inventory, cost and maintenance.

Strategic and Operational Decisions: Operations management decisions can also be viewed as comprising of strategic and operational decisions. Strategic decisions are long-term decisions and are decisions which organisations take to meet their aims and objectives taking into account the changing environment. Strategic decisions are difficult to change once taken. Strategic decisions can pertain to selection of product and product design, selection of process, facilities, location and layout, materials handling and capacity planning. The operational decisions are short-term decisions which aid in the fulfilment of the strategic decisions. Operational decisions pertain to production planning, scheduling and control; inventory planning and control, quality control, work and job design, maintenance and cost control.

Operations management decisions need to be reviewed and updated on a periodic basis in order to take into consideration the changes in the environment. Also the conversion system should be monitored on a continuous basis and feedback regarding actual *vs.* planned performance should be utilised to find tune of the conversion process.

TYPES OF PRODUCTION SYSTEMS

There are four types of production systems described as follows:

Production Systems	Description
Mass Production System or Assembly Line	The processing of materials from the input to the output stage takes place in a sequence in a linear flow. Machineries used in mass production system are specific. Mass production system is appropriate for producing high volume low variety outputs. The main problem in a mass production system is line balancing and reducing bottlenecks.

Production Systems	Description
Batch Production System	Batch production system is appropriate for more variety and small volume of outputs. The outputs are produced in batches and stored. The flow of materials from the input to the output stage is not linear. The demand is met out of the inventory of stored outputs. Whenever the inventory level of a certain output falls below a certain level, production for that output is called for. In a batch production system a single machine is used for processing several products. The major problems in a batch production system are designing an optimal layout plan, working out an aggregate production plan, allocation of jobs to machines, determining the optimum inventory level and scheduling and sequencing of operations.
Job Shop	A job shop production system is highly flexible and can accept a vast variety of jobs as according to the demand. The output is of high variety and low volume. Material flow in a job shop from the input to the output stage is non-linear and complex. The processing in a job shop can be carried out on the basis of various criteria or rules. The rule can be shortest processing time, Earliest due date, first come first served etc. The main problem in a job shop production system is deciding the criteria or rule of processing.
Unit Manufacture of Projects	This type of production system is appropriate for manufacturing large sized products such as airplanes or ships. The products cannot be carried to the facilities, hence, the facilities (machineries and manpower) are brought to the product location. The production is undertaken as a project. The project is managed using the concepts of PERT/CPM.

MANAGEMENT OF MATERIALS IN PRODUCTION SYSTEMS

Materials play a very important role in the conversion process. In several industries, materials account for almost 60-70% of the cost of production. Proper management of materials can lead to a cost reduction of 15-20%.

The approaches to materials management are several and all the approaches need to be applied in an integrated manner for achieving the best results. The various approaches to materials management are as follows:

Analysis of the Purchase Price and Value of Materials: An analysis of the purchase price and value of materials can aid in reducing prices and increasing value of purchased materials through better sourcing, better vendor selection etc.

Materials Handling: The production facilities should provide for optimum materials handling. Excessive handling of materials should be avoided but availability of materials should be ensured at the point of requirement. All the required materials handling equipments as well as machineries should be provided for.

Inventory Control: The inventory of materials should neither be in excess nor in shortage, but should be maintained at an optimum level so as to avoid increased storage and inventory carrying costs and also to ensure availability and avoid risks associated with shortages.

Stores Management: The layout of the stores should enable quick and easy access of materials. The store should be well maintained, clean and ventilated to keep wastages at minimum.

Waste Management: Wastes generated at each stage of the conversion system should be analysed and attempted to be reduced if not eliminated. Recycled waste products should be used as inputs as far as possible.

CONCEPTS IN SYSTEMS LIFE-CYCLE

The life-cycle concept holds that all systems pass through four stages which are namely: Introduction, growth, maturity and decline. The operations system comes into existence with the formulation of corporate goals and choice of output and setting up of the operations facility. Teething problems are eliminated in the growth stage and before reaching maturity the system achieves full capacity and economies of scale. After having reached at saturation point there is a decline in growth rate. The organisation needs to now relook its objectives after considering the changes in the external environment and take strategic decisions regarding revival, salvation or starting new business. All decisions including investment decisions pertaining to operations should be taken by considering the entire life-cycle of the system and not only a particular stage.

ROLE OF SCIENTIFIC METHODS IN OPERATIONS MANAGEMENT

Scientific method calls for systematic and objective approach and application of reason and logic to solve problems. The roles of various scientific methods used in operations management are discussed as follows:

Industrial Engineering: It is concerned with creating apt systems of conversion comprising of men, materials, machineries and equipments. In order to create apt conversion systems industrial engineering borrows knowledge from several subjects such as mathematics, physical and social sciences and engineering.

Models: Models can be used for representing real life situations including conversion systems. Models can be mathematical or structural. Structural model can depict a detailed description of the real setup on a reduced scale. Mathematical models provide mathematical relations between various entities of a system. Mathematical models can be used for analysing the real system by filling in the appropriate coefficients.

Computers: Computers help in providing speedier solutions to problems and automating several processes and activities which are repetitive. Computers can be used for data processing, management information, decision analysis and communication purposes.

Behavioural Sciences contribute in designing the appropriate organisation structure, design of work, remuneration and performance appraisal systems.

BRIEF HISTORY OF OPERATIONS MANAGEMENT

A social change in the industrial revolution era which demanded the respect of all citizens and downfall of dictatorships gave birth to classical and behavioural schools of thought that identified factors which motivated people to work. The classical school of thought focused on the technical and scientific aspects while the behavioural school of thought was concerned with the effect of operations on human behaviour.

Following is a brief time line on the evolution of the subject of Operations Management:

1776-1911		
1776	Division of Labour	Adam Smith
1832	Division of labour and assignment of jobs by skills and time study basis	Charles Babbage
1878-1911	Job analysis and job design to increase efficiency and principles of scientific management. The principles mainly described: replacement of thumb's rule by scientific	F.W. Taylor