ROHINI COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF MATHEMATICS

LECTURE NOTES ON

BA4201 / QUANTITATIVE TECHNIQUES FOR DECISION MAKING

UNIT IV : INVENTORY MODELS

INTRODUCTION to INVENTORY SYSTEM

INTRODUCTION

Inventory may be defined as a stock of idle resources of any kind having an economic value kept for the purpose of future affairs. Simply inventory is a stock of physical assets. The physical assets have some economic value, which can be either in the form of material, men or money. Inventory can be in the form of physical resource such as raw materials, semi-finished goods used in the process of production, finished goods which are ready for delivery to the consumers, human resources, or financial resources such as working capital etc.

Various costs associated with inventory model are often classified as follows:

➢ **Purchase (or production) cost**. The cost of purchasing (or producing) a unit of an item is known as purchase (or production) cost. The purchase price will become important when quantity discounts are allowed for purchases above a certain quantity.

➢ **Ordering (or set up) cost**. If any item is purchased, an ordering cost is incurred each time an order is placed. This cost includes the following factors: administrative (paper work, telephone calls, postage), transportation of items ordered, receiving and inspection of goods etc. If a firm produces its own inventory instead of purchasing the same from an outside source, then production set-up

costs areanalogous to ordering costs.

➤ **Carrying (or holding) cost**. Holding cost represents the cost of maintaining inventory in stock. It includes the interest on capital, sent for space used for storage, insurance of stored equipment, depreciation, taxes, etc.

➤ **Shortage (or stock out) cost**. The penalty cost for running out of stock (i.e. when an item cannot be supplied on the customer's demand) is known as shortage cost. This cost includes the loss of potential profit through the sale of items demanded and loss of goodwill, in terms of permanent loss ofcustomers and its associated lost profit in future sales.

➤ **Salvage cost (or selling price)**. When the demand for an item is affected by its quantity in stock, the decision depends upon the underlying criterion and includes the revenue from sale of the item. Salvage cost is generally combined with the storage cost and hence is neglected.

➤ **Demand**: Demand is the number of units required per period and may be either known exactly or knownin terms of probabilities. Problems in which demand is known with certainty, are called deterministic problems, whereas problems in which demand is assumed to be a random variable are called **probabilistic problems**.

➤ **Order cycle**. The time period between placements of two successive orders is referred to as an order cycle.

➤ **Time horizon**. The time period over which the inventory level will be controlled is referred to as timehorizon. This can be finite or infinite depending upon the nature of demand. This is also known as the planning period over which the inventory is to be controlled.

➤ **Lead time**. The time between placing an order and its arrival in stock is known as lead time. The lead time can be either deterministic or probabilistic. If the lead time is zero, there is no need for placing an order in advance.

➤ **Economic Order Quantity (EOQ):** Economic order quantity is the size of the order

representing standard quality of material and is the one for which the aggregate of the costs of procuring the inventory and costs of holding the inventory is minimum.

- ➤ **Re-order level**. The level between maximum and minimum stock, at which the purchasing (or manufacturing) activities must start for replenishment is known as reorder level.

- ➤ **Stock replenishment**: The rate at which items are added to inventory is one of the important parameters in inventory models. The actual replenishment of items may occur instantaneously or gradually. Instantaneous replacement is possible when the stock is purchased from outside sources while gradual replenishment is possible when the product is manufactured by the company.

- ➤ **Re-order quantity**: This is the quantity of replenishment order. In certain cases, it is the Economic Order Quantity.

- ➤ **Decoupling:** Use of inventories to break apart operations so that one operations supply is independent of another.

- ➤ **Backlog:** Accumulation of unsatisfied demands

- ➤ **Delivery Lag:** Time between the placing of an order for the item and receipt of the items for use.

- ➤ **ABC Classification:** Classifications of inventories in terms of annual usage value in different categories of high value (A), medium value (B) and low value (C).

- ➤ **VED Classification:** Vital Essential Desirable Classification. This is based on experience/judgment. VED classification when coupled with ABC classification enhances the inventory control efficiency.

Objectives

Inventory has the following main objectives:

- ➤ To supply the raw material, sub-assemblies, semi-finished goods, finished goods, etc.
- ➤ To maintain the minimum level of waste, surplus, inactive, scrap and obsolete items.
- ➤ To minimize the inventory costs such as holding cost, replacement cost,

breakdown costand shortage cost.

- ➤ To maximize the efficiency in production and distribution.
- ➤ To maintain the overall inventory investment at the lowest level.

Notations

Q = number of units ordered per order

D = demand in units of inventory per time period (R)

N = number of orders placed per time period

TC = total inventory cost

C_3 = ordering cost (or setup cost per production run) per order

C_1 = Carrying or holding cost per unit per period of time the inventory is held

C = Purchase or manufacturing price per unit inventory

C_S = shortage cost per unit of inventory (C_2)

L = lead time

T = reorder cycle time i.e. time period between placement of two successive orders as a fractionalpart of standard time horizon

Control Inventory (ABC Analysis)

A good way of examining an inventory control is: to make ABC classification, which is also known as ABC analysis. ABC analysis means the "control" will be "Always Better" if we start with the ABC classification of inventory.
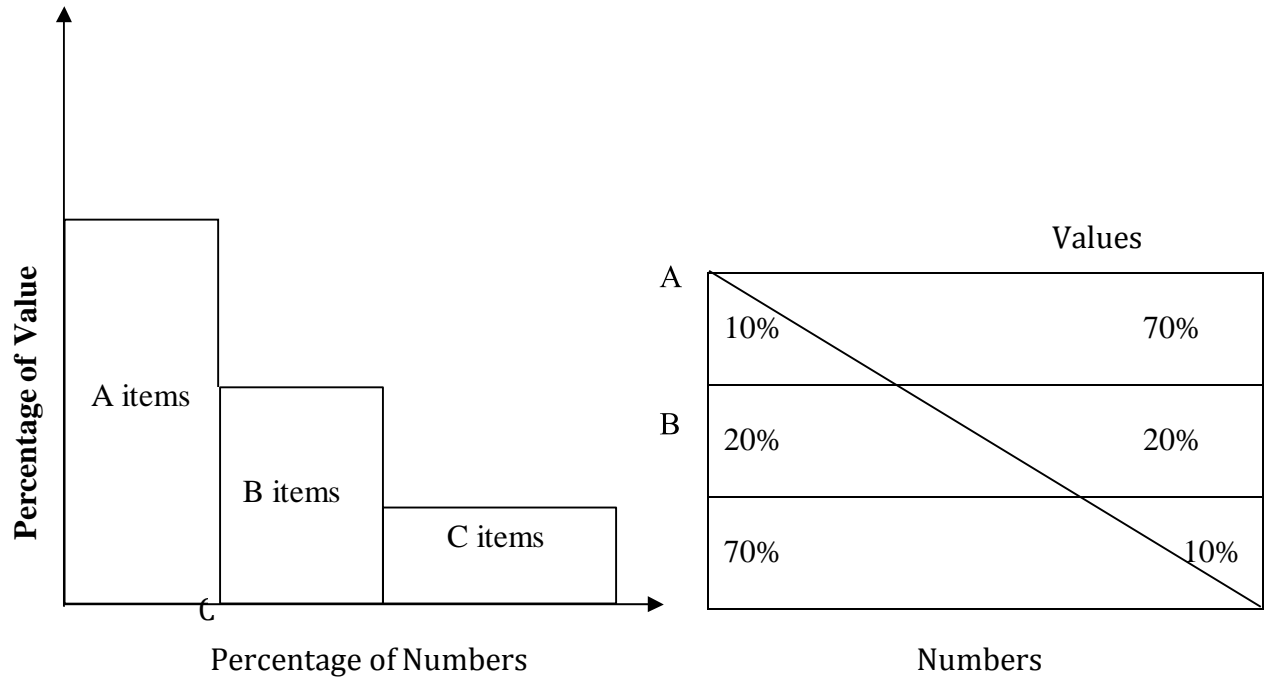
The three groups of inventory items are called A-items group, B-items group, C-items group, which are explained as follows:

A-items Group: This constitutes 10% of the total number of inventory items and 70% of total moneyvalue for all the items.

B-items Group: This constitutes 20% of the total number of inventory items and 20 % of total moneyvalue for all the items.

C-items Group: This constitutes 70% of the total number of inventory items and 10 % of total moneyvalue for all the items. This is just opposite of A-items group.

The ABC classification provides us clear indication for setting properties of control to the items, and A-class item receive the importance first in every respect such as tight control, more security, and high operating doctrine of the inventory control.

The coupling of ABC classification with VED classification enhances the inventory control efficiency. VED classification means Vital, Essential and Desirable Classification. The ABC /VED classification is presented in thefollowing table.

	V	E	D	Total
A	3	5	2	10
B	5	7	8	20
C	10	40	20	70
Total	18	52	30	100