

# Inventory Management.

Inventories are assets of a business. Generally inventories form about 20 to 30% of the total assets of a manufacturing enterprise. Inventories require investment of funds. If the inventories are too big, they become a strain on the resources. If they are too small, the firm may lose the sale. Therefore, the firm must have an optimum level of inventory. For this, an efficient management of inventory is essential. Managing the level of inventories is like maintaining the level of water in a bathtub. The water is flowing out continuously. If the water is let in too slowly, the tub is soon empty. If water is let in too fast, the tub overflows. Like the water in the tub, if the firm stocks too less inventory, it will be exhausted soon. The firm loses sale. On the other hand, if the firm maintains too much inventories, there may be waste. Thus the basic problem is to determine the proper level of investment in inventories and to decide how much inventory must be acquired during each period to maintain that level.

## **Meaning of Inventories**

A retail shopkeeper keeps an inventory of finished products to be sold to customers whenever they demand. A manufacturing concern has to keep stocks of not only the finished goods but also of all physical ingredients being used in the production process. The term inventory simply refers to stock. Inventories are the stocks of the product a company is manufacturing

for sale and the components that make up the product. These are the assets that will be sold off in future in the normal course of business operation.

### **Types or Forms of Inventory**

The inventory of a manufacturing concern is classified into the following three types:

1. **Raw materials inventory:** These are material inputs of production process. These are used to manufacture the final product.
2. **Work in progress inventory:** These are semi-finished products. These are the products that need more work before they become finished products.
3. **Finished goods inventory:** These are finished or final products which are ready for sale. In the case of trading concern, the unsold finished product is called finished goods inventory.

### **Meaning of Inventory Management**

Inventory requires large capital investment. If inventory is not properly managed, it may affect the production, marketing and finance departments. Ultimately this may affect the existence and growth of the business. If a firm carries too much inventory, it will run out of cash. Its capital will be unnecessarily tied up in excess inventory. This is so because inventory is illiquid. It brings no return. Rather it brings certain disadvantages. In the same time, if a firm carries too little inventory, it may result in stock outs. The firm may lose sales. It may lose future customers as well because stock-outs result in customer dissatisfaction. So inventories require proper management and control.

Inventory management simply refers to management of inventory. Inventory management may be defined as the overall way a company manages its inventory and uses its control system to manage the benefits of carrying inventory against the cost. Although the finance department does not itself manage the firm's inventory, it has a responsibility to ensure that the inventory is being managed effectively and efficiently.

### **Objectives of Inventory Management**

Any firm will like to hold higher levels of inventory. This will enable the firm to be more flexible in supplying to the customers. Most of the customers may require immediate delivery. Higher inventories may help

meeting their demands. Thus there is no chance of loss of sale. These are the benefits of carrying higher level of inventory. As against the benefits, there are certain costs of inventory. The cost includes capital cost of the stock (investment) and the costs of storing and carrying. On the other hand, holding lower level of stock than required may result in stock outs. The cost of stock-out may be in the form of loss of sales or customers' dissatisfaction. The stock outs may also result in delays or interruption in the production process. Thus holding too much inventories and too less inventories, both are undesirable. So, every firm is required to manage the inventories in such a way as to get the best return out of it. It must weigh the benefits of holding inventory against its costs. Then only the firm can maintain optimum inventory. This is the basic objective of inventory management. The objectives of inventory management may be summarised as follows:

1. To ensure that adequate inventories are available for smooth operation.
2. To minimise investment of funds in the inventories.
3. To minimise the costs of ordering and carrying inventories.
4. To maximise the wealth of the shareholders (i.e. to maximise profitability).
5. To avoid cash crisis.
6. To avoid both over-stocking and under-stocking of inventories.
7. To minimise losses on account of obsolescence, pilferage, wastage etc.
8. To ensure right quality products at reasonable prices.

The basic objective of inventory management is to determine the optimum level of inventory, i.e. the level at which the interests of all the departments are taken care of.

### **Motives for Holding Inventory**

Every firm, big or small, trading or manufacturing, has to maintain some minimum level of inventories. There are different motives for maintaining inventories. These motives are more or less the same as the motives for holding cash. The motives for holding inventory are:

- (a) **Transaction motive:** Every firm has to maintain some level of inventory to meet the day-to-day requirements of sales, production process, customer demand etc.

- (b) **Production motive:** A firm should keep some inventory for unforeseen circumstances also. For example, there may be a strike in the factory and the production process may halt.
- (c) **Speculative motive:** The firm may keep some inventory in order to capitalize an opportunity of making profit.

### Benefits and Costs of Inventories

As already stated, the inventory has costs as well as benefits associated with it. While determining the optimum level of inventories, the financial manager must consider the necessity of holding inventory and the costs thereof.

#### Benefits of Inventories

The following are the reasons or benefits of holding inventories:

1. **Uninterrupted production:** Every manufacturing firm must have sufficient stock of raw materials for the regular and continuous production. If there is stock-out of raw materials at any stage of production process, the production will be interrupted. Goods cannot be delivered in time. This may result in customer dissatisfaction. If sufficient stock is maintained, production can be carried on even if there is shortage of inventories in the market.
2. **Independent sales:** In most of the cases goods cannot be produced just after receiving orders. Therefore, every manufacturing concern maintains a minimum level of finished goods in order to deliver the goods as soon as the order is received. Thus the loss related to the gap between demand and supply of goods is avoided.
3. **Goodwill with customers:** Meeting the demand of customers in time creates goodwill and customer loyalty.

#### Costs of Inventory

The following costs are associated with inventory:

1. **Ordering costs:** These are costs of placing orders. These costs depend upon the number of orders and not on quantity of inventory ordered. Ordering costs include cost of preparation of purchase order, cost of receiving goods, transport costs, documentation processing costs, etc. These are also known as *acquisition* or *setup costs*.

2. **Carrying costs:** These are the costs incurred in keeping or holding inventory. These include storage costs (rent, lighting etc.), handling cost, insurance, security costs, cost of pilferage and damage, depreciation, opportunity cost of money tied up in inventory (interest) etc.
3. **Stock-out costs:** A stock-out is a situation when the firm is not having items in store but there is a demand for the same. If the firm runs out of stock of finished goods, it may lose sales. It may lose goodwill also. Thus stock-out costs include loss of profit due to loss of sale, loss of future sale, loss of goodwill etc. These are also known as *shortage costs*.

### **Techniques of Inventory Management**

In order to keep an optimum level of inventory and minimise the investment in inventories, management should try to balance out the expected cost and benefits of maintaining inventories. Various techniques have been suggested for the efficient management of inventories. Important techniques of inventory management are as follows:

1. Economic order quantity.
2. Classification and codification of inventories.
3. Stock levels.
4. Safety stock.
5. Inventory turnover ratio.
6. ABC analysis.
7. VED analysis.
8. Aging schedule of inventories.
9. Perpetual inventory system.
10. JIT inventory system.

These techniques may be briefly discussed in the following pages:

which are relating to acquisition of materials. These include the cost of placing a purchase order. Examples are transportation cost, salaries of staff engaged in placing order, salaries of staff engaged in receiving and inspection, cost of stationery, telephone etc. Carrying costs refer to cost of holding or carrying the stock in storage (i-e storage costs). These include rent and insurance of stores, clerical costs, interest on capital locked up in store, stores staff salaries, obsolescence and wastages of materials etc. Practically, the two costs have inverse relationship. If the order quantity is larger, the ordering costs will be low, because orders placed are few but the carrying or storage cost will be high. Therefore the ordering quantity should be fixed at that level where the total cost of inventory (ordering cost + carrying costs) is lowest. This is possible when the ordering cost is equal (or balanced) to carrying or storage cost. Thus EOQ is that quantity at which the total inventory cost is minimum i-e the ordering cost and carrying costs are equal.

### Assumptions of EOQ

EOQ is based on the following assumptions:

1. The demand for the material (i-e consumption) is exactly known.
2. The consumption rate is constant.
3. The purchase price of material per unit is fixed.
4. The carrying cost or storage cost per unit is fixed.
5. The ordering cost per order is fixed.
6. The quantity of material ordered is received immediately, i.e. the lead time is zero.

### Determination of EOQ

There are four methods or approaches to determine EOQ. They are as follows:

1. Algebraic method
2. Graphical method
3. Tabular method
4. Cost comparison method

**Algebraic or formula method:** This method is very useful if the purchase price of material does not fluctuate from one order size to another. Under this method, EOQ is computed by the following formula:

$$EOQ = \sqrt{\frac{2CO}{I}}$$

where, C = Annual consumption or usage of material

O = Cost of placing an order

I = Annual carrying or storage cost per unit. It is usually calculated as a given percentage of value of material per unit.

The following points should be noted:

1. If in a question, requirement of material is given as weekly, monthly or half yearly, it should be converted into annual requirement.
2. If the carrying or storage cost is given as percentage of average stock price per unit per year, calculate the carrying cost by multiplying the percentage with purchase price of material per unit.

### Example 1

Calculate EOQ from the following information. Also calculate the number of orders to be placed in a year:

Annual consumption	10,000 Kg.
Cost of placing an order	Rs. 50
Cost per Kg. of material	Rs. 2
Storage cost	8% on average inventory

### Solution

$$EOQ = \sqrt{\frac{2CO}{I}}$$

Where, C = 10,000; O = Rs. 50; I = 8% of Rs. 2 = 0.16

$$\sqrt{\frac{2 \times 10,000 \times 50}{0.16}} = 2,500 \text{ Kg.}$$

No. of orders to be placed in a year

$$= \frac{\text{Annual consumption}}{EOQ} = \frac{10,000}{2,500} = 4 \text{ orders per year.}$$

(c) If EOQ is less than the minimum quantity for availing discount, then the discount offer should be evaluated in terms of the total cost of maintaining inventory with and without discount.

**Example 4**

The following information is available in respect of the inventory costs of a firm:

Total annual consumption	600 units
Cost per unit	Rs. 6
Order Cost	Rs. 10 per order
Carrying cost	20%

Discount of 5% is offered on an order of 200 units. Evaluate the discount offer.

**Solution**

$$EOQ = \sqrt{\frac{2CO}{I}}$$

$$I = 6 \times 20\% = 1.20$$

$$EOQ = \sqrt{\frac{2 \times 600 \times 10}{1.20}} = 100 \text{ units}$$

The quantity discount is available only if the ordering quantity is at least 200 units. Therefore the discount offer is to be evaluated.

	EOQ (without discount)	Q (with discount)
No. of units per order	100	200
No. of orders p.a. (600/100 and 600/200)	6	3
Average inventory (100/2 and 200/2)	50	100
Cost per unit (net) (6 - 5%)	6	5.70
Carrying cost of avg. inventory (A)	50 x 6 x 20% = Rs. 60	100 x 5.70 x 20% = Rs. 114
Total Ordering cost (B)	6 x 10 = Rs. 60	3 x 10 = Rs. 30

Cost of Purchase (annual requirement x Cost p.u) (C)	$600 \times 6 = \text{Rs. } 3,600$	$600 \times 5.70 = \text{Rs. } 3,420$
Total Cost (A + B + C)	Rs. 3,720	Rs. 3,564

It can be seen that the total cost in case of discount is less than the EOQ. Therefore the firm shall avail the discount offer.

### Benefits of EOQ

EOQ is a useful technique of inventory management. It tells the quantity to order and also the time to order. It helps in deciding when to replenish the inventory and also the quantity to be replenished. In short, it helps in maintaining an optimum level of inventory.

### Limitations of EOQ

1. The total usage of an item during a particular period is difficult to be known with certainty.
2. The assumption that constant rate of consumption of inventories is not feasible in actual situations. The rate of consumption may vary over time.
3. The assumption that quantity ordered is received immediately is not realistic. The supply may not immediately reach the firm as soon as the order is placed.

### Classification and Codification of Materials

For efficient storage, proper classification and codification of materials is necessary. Classification of materials refers to grouping of materials according to their nature in suitable categories. For example, iron, aluminium, copper etc. may be classified as metals, items like soap, cotton waste, lubricating oil etc. may be classified as consumable stores, all forms of tools including jigs and fixtures may be classified as tools etc. The classification of materials facilitates convenience in material handling and their easy identification.

Having classified the materials, the next step is to codify the materials. Codification is the process of giving distinct numbers or letters or symbols to each item of material to facilitate easy identification. Thus the number or letter or symbol is a code. It is secret and short name of material item.

### Advantages of Classification and Codification

1. It helps in easy identification of materials.
2. It maintains secrecy of materials.

3. It is essential for mechanised accounting.
4. It ensures clarity.
5. It reduces clerical work.
6. It facilitates speedy movement of materials.
7. It helps in overall material control.

### Stock Levels

Inventory management aims at maintaining stock of materials at optimum level. There should be neither overstocking nor understocking. In order to avoid overstocking and understocking of materials or to minimise the total cost of inventory, management may fix certain stock levels like maximum level, minimum level, reorder level, average level and danger level.

**Maximum level:** Maximum stock is the upper level of inventory. It is the maximum quantity of an item of material that can be held in stock at any time. This is the level above which stock should not be maintained. The main purpose of this level is to avoid overstocking of materials and unnecessary blocking of capital in inventories. Maximum level is computed as follows:

$$\text{Maximum level} = \text{Reorder level} + \text{Reorder quantity} - (\text{Minimum consumption} \times \text{Minimum reorder period})$$

**Factors to be considered:** While fixing the maximum level, the following factors should be considered:

(a) Rate of consumption of material, (b) Availability of funds, (c) Storage space available, (d) Time necessary to obtain new materials, (e) Storage cost, (f) Economic order quantity, (g) Seasonal and cyclical fluctuations, (h) Risk of obsolescence.

**Minimum Level:** Minimum stock level is the minimum quantity of stock that should be held at all times. It is that level below which stock should not normally be allowed to fall. The main purpose of this level is to ensure that production is not stopped due to non-availability of materials. Minimum stock level is computed by the following formula:

$$\text{Minimum level} = \text{Reorder level} - (\text{Normal consumption} \times \text{Normal reorder period})$$

Normal consumption means average consumption of material.

Normal or average reorder period is computed as follows:

$$\frac{\text{Minimum reorder period} + \text{Maximum reorder period}}{2}$$

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**Factors to be considered:** In fixing the minimum level, the following factors should be considered:

(a) Nature of item of material, (b) Average time required to get new materials, (c) Average rate of consumption of material, (d) Production requirements, (e) Reorder level, (g) Reorder quantity.

**Reorder Level (Ordering Level):** This is the level at which order is placed for further supply of materials. When the stock of material reaches this level, the storekeeper should initiate action for the purchase of material. Reorder level is fixed somewhere between minimum level and maximum level. It must be fixed in such a way that the stock representing the difference between reorder level and minimum level should be sufficient to meet demands of production till new materials arrive. Reorder level is computed as follows:

$$\text{Reorder level} = \text{Maximum consumption} \times \text{Maximum reorder period}$$

Or

$$\text{Minimum level} + \text{Average consumption} \times \text{Average reorder period.}$$

**Factors to be considered:** While determining reorder level, the factors to be taken into consideration are:

(a) Rate of consumption, (b) Reorder period, (c) Variation in reorder period, (d) Minimum level, (e) Economic order quantity.

**Average stock level:** This is the average stock held by a concern. It is calculated by the following formula:

$$\text{Average stock level} = \text{Minimum level} + \frac{1}{2} \text{Reorder quantity}$$

Or

$$\frac{\text{Minimum level} + \text{Maximum level}}{2}$$

2

**Note:** The first formula is the refined formula. Hence students may follow the first formula.

**Danger level:** This is the level of stock below which the stock should never be allowed to fall. If the stock level falls below the minimum level is

called the danger level. When stock reaches danger level, urgent and emergency action should be taken to replenish the stock so that production is not stopped. Danger level is rightly described as *danger warning level*. Danger level is calculated by the following formula:

$$\text{Danger level} = \text{Average consumption} \times \text{Maximum reorder period for emergency purchases.}$$

**Reorder Period:** In connection with stock levels, the term reorder period refers to the time required to obtain new materials. It is the time gap required between placing an order and the actual receipt of the materials. In short, it is the time lag in procurement of materials. Sometimes reorder period is called lead time or delivery period.

### Example 5

From the following data for the last year, calculate stores stock levels:

Maximum usage in a month 300 numbers

Minimum usage in a month 200 "

Average usage in a month 225 "

Time lag for procurement of materials:

Maximum - 6 months

Minimum - 2 months

Reorder quantity 750 numbers

### Solution

$$\begin{aligned} \text{Reorder level} &= \text{Maximum consumption} \times \text{Maximum reorder period} \\ &= 300 \times 6 = 1,800 \text{ Nos.} \end{aligned}$$

$$\begin{aligned} \text{Maximum level} &= \text{Reorder level} + \text{Reorder quantity} - (\text{Minimum} \\ &\quad \text{consumption} \times \text{Minimum reorder period}) \\ &= 1,800 + 750 - (200 \times 2) = 2,150 \text{ Nos.} \end{aligned}$$

$$\text{Minimum level} = \text{Reorder level} - (\text{Normal consumption} \times \text{Normal reorder period})$$

Here normal reorder period is to be ascertained.

$$\text{Normal reorder period} = \text{Maximum reorder period} + \text{Minimum reorder period}$$

$$= \frac{6+2}{2} = 4 \text{ months}$$

$$= 1800 - (225 \times 4) = 900 \text{ Nos.}$$

$$\begin{aligned} \text{Average stock level} &= \text{Minimum level} + \frac{1}{2} \text{ Reorder quantity} \\ &= 900 + \frac{1}{2} \text{ of } 750 \\ &= 1,275 \text{ Nos.} \end{aligned}$$

**Note:** Even if reorder level is not asked to be found, it must be ascertained first to find maximum and minimum levels.

### Safety Stocks

The usage rate of inventory (or sales or demand rate) and delivery time are not easily predictable. The usage rate may vary over time. Likewise, materials ordered do not always arrive in time. These factors may lead to stock-outs. This can be largely avoided by carrying a safety stock of inventory for emergencies. A safety stock is an additional supply of inventory that is carried all the time to be used when normal stocks run out. It is the minimum additional inventory to serve as a safety margin or buffer or cushion to meet an unanticipated increase in usage. If an order is placed when the inventory reaches 250 units instead of 200 units, the additional 50 units constitute the safety stock. The safety stock protects the firm from stock-outs due to unanticipated demand for an item or slow deliveries. Increasing the amount of inventory held as safety stock reduces the chances of stock-outs. Therefore it reduces stock-out costs. But the level of investment is increased by the amount of the safety stock.

In determining the right (optimum) quantity of safety stock, the firm has to consider two types of costs. These two costs are: (a) Opportunity cost of stock-out, and (b) carrying costs. If a firm maintains large quantity of safety stock, carrying cost will be larger, but opportunity cost will be lower. On the other hand, if a firm maintains low level of safety stock, frequent stock-outs will occur. This results in higher opportunity costs. But carrying costs will be low. Thus the optimum level of safety stock involves a trade off between the costs of stock-outs and the carrying costs of safety stock. The safety stock will be optimum when the total costs of carrying and stock out cost is at minimum.

**Inventory Turnover Ratio**

Material turnover ratio is the ratio of cost of material consumed during a given period to the average stock during that period. It indicates the speed with which the raw materials have been consumed in production. It gives the number of times in a year stock is used up and replenished. In short, it shows the rate of consumption of materials. Stock turnover ratio is called *stock velocity*. It is computed as follows:

$$\text{Stock Turnover Ratio (Times)} = \frac{\text{Cost of material consumed}}{\text{Average stock}}$$

$$\text{Cost of material consumed} = \text{Opening stock} + \text{Purchases} - \text{Closing stock}$$

$$\text{Average stock} = \frac{\text{Opening stock} + \text{Closing stock}}{2}$$

Material turnover ratio can also be expressed in days as follows:

$$\text{Material turnover ratio (days)} = \frac{365}{\text{Material turnover ratio in times}}$$

**Interpretation of the Ratio:** A high turnover ratio (lesser days) indicates that materials are fast moving, lower obsolescence, lower average carrying cost and material losses etc. A lower turnover ratio on the other hand, indicates that materials are slow moving, higher obsolescence, larger average carrying cost and material losses, excess stock etc.

**Significance of Material Turnover Ratio:** Material turnover ratio is useful to avoid unnecessary investment in those materials whose consumption is much less. It also helps to avoid obsolescence of stock and incurring of unnecessary storage costs. Through this ratio it is possible to know whether the materials are fast moving or slow moving. In other words, this ratio indicates that for how many days the materials remain in stock. Thus the stock turnover ratio is an important indicator of efficiency in material management.

**Example 6**

From the following data for the year ended 31-03-03. calculate the inventory turnover ratio of two items and put forward your comments on them:

	Material A Rs.	Material B Rs.
Opening stock	40,000	36,000
Purchases during the year	2,08,000	1,08,000
Closing stock	24,000	48,000

**Solution**

*Calculation of cost of material consumed:*

	A Rs.	B Rs.
Opening stock	40,000	36,000
Add: Purchases	2,08,000	1,08,000
	<hr/>	<hr/>
	2,48,000	1,44,000
Less: Closing stock	24,000	48,000
	<hr/>	<hr/>
Cost of material consumed	2,24,000	96,000

Average stock	=	$\frac{40,000 + 24,000}{2}$	=	$\frac{36,000 + 48,000}{2}$
	=	32,000		42,000

Inventory turnover ratio	=	$\frac{\text{Cost of material consumed}}{\text{Average stock}}$
	=	$\frac{2,24,000}{32,000}$
	=	7 times
Inventory turnover in days	=	$\frac{365}{7}$
	=	52 days

**Comments:** Material A is fast moving because its turnover ratio is higher. Material A is lying in stock for 52 days only. As compared to material A.

material B is slow moving. Turnover ratio of material B is lower. It is lying in stock for a longer period (i-e 159 days).

### **Selective Inventory Control**

In many walks of life, we find the phenomenon 'the vital few and trivial many'. For example, in a TV set, 5% of its part contribute to 80% of its cost. In India only 10% of the population pays taxes. In our body only 10% of organs are vital to sustain life. This discovery was made by Pareto and the Phenomenon is called Pareto's Law. He was a German economist who worked out the distribution of incomes in East Russia and found that 20% of the people got 80% of the money. This law is commonly used in welfare economics.

The same phenomenon is noticeable in inventories as well. One would find that 20% of the total stock contribute to 80% of the value. And these 20% are most crucial as far as company's production is concerned. Realising this phenomenon, inventory control in its attempt to reduce the cost of inventory, adopts the policy of selective control. In selective inventory control, inventory of high value items is controlled because they give greatest returns. Also, not much care is assigned for the low value items, because the returns are low.

The various selective inventory control techniques are:

ABC Analysis, VED Analysis, SAP Analysis, FSN Analysis, HML Analysis, SDE Analysis, SOS Analysis, GOLF Analysis, XYZ Analysis etc. Only ABC Analysis and VED Analysis are discussed here:

### **ABC Aanalysis (Always Better Control)**

The concept of ABC analysis was coined by Pareto, an Italian philosopher in the nineteenth century. He illustrated graphically the fact that most of the wealth in Italy was owned by a small proportion of the population. Likewise an analysis of material cost in all factories revealed that about 80% of the total value of issues accounts for 20% of the items.

In the case of large concerns large number of items are kept in the stores. Therefore, it is practically impossible to concentrate on each and every item. In such situations, ABC analysis is used with a view to exercise better control over materials. It is one of the best and popular techniques of inventory control. Under ABC analysis all materials are classified into three categories - A, B and C according to value. Category A includes high

value materials (costlier materials). Category B includes medium or moderate value of materials (less costly materials). Category C includes lower value materials (least costly materials). According to this technique a greater or strict control is exercised over category A materials, a moderate control is exercised over category B materials and relatively lesser degree of control over category C materials. Thus ABC analysis is an analytical technique of material control that divides materials into three categories and uses different degrees of control over each category. It aims at concentrating efforts in those items where attention is needed most. Thus it is the 'management by exception' system of inventory management. The following example helps to understand the concept:

Category	% of total number of items	% of total material cost (value)
A	10	70
B	20	25
C	70	5

Category A materials represent 70% of the total material cost (value), but it constitutes only 10% of the items or quantity (high value materials). Category B materials represent 25% of the total material cost, constitute 20% of the material items (middle value materials). Category C though constitutes 70% of the total items, it represents only 5% of the total value (low value materials). Thus this method assumes that smaller number of items in inventory may have larger money value, and the larger number of items have smaller money value. ABC analysis is also called *proportional parts value analysis* or *demand and supply method*.

#### **Advantages of ABC Analysis**

1. It ensures closer and stricter control over costly items of materials in which large amount of capital is invested.
2. It helps to use working capital in a better way.
3. It leads to reduction in costs.
4. It reduces clerical costs.
5. Investment in materials can be regulated.
6. It helps to maintain high stock turnover ratio.

Without these, production can be done only for few hours or a day. If they are out of stock for a long period, production will stop. Desirable spares are those which are required for production, but factory can manage without them for some time, say, a week or even more because they have some substitutes. While exercising control, greater attention should be paid on vital spares.

**Aging Schedule of Inventories**

A schedule in which inventories are classified according to the period (age) of their holding in the stores is called aging schedule of inventory. It shows the age of inventories or the period for which inventories are lying in stock together with the percentage of each inventory of total inventory. It helps to identify the rate at which various inventories are consumed. This will help in identifying slow moving inventories. This will further help in effective control and management of inventories. Look at the following example:

**Aging Schedule** as on January 31, 2006

Age Classification (in days)	Date of Purchase or manufacture	Amount Rs.	Percentage to Total
0 - 15	Jan. 16	10,000	25%
16 - 30	Jan. 2	14,000	35%
31 - 45	Dec. 16	6,000	15%
46 - 60	Dec. 3	8,000	20%
61 and above	Before Dec. 3	2,000	5%
		40,000	100%

It can be seen that 60% of the items are consumed within 30 days, while only 5% of the items are older than 60 days.

**Stock Verification (Inventory System)**

Generally the materials purchased for production are not fully consumed. There is some quantity of stock at any time. To check the material losses, it is necessary to properly verify the material in stock. There are two main methods of verification of materials (inventory system) - periodic inventory system and perpetual inventory system.

**Periodic Inventory System:** Under periodic stock verification the entire stock is verified at a time at periodic intervals, usually once a year (at the close of the accounting period). Thus stock taking at the end of the year (or half year) is called periodic stock taking or periodic inventory system. The entire material is physically counted and the value of closing stock is ascertained for the purpose of preparation of final accounts. During the period of physical stock taking, the factory has to be closed. Hence periodic inventory system is not suitable to large business houses. In such cases perpetual inventory system is followed.

**Perpetual Inventory System:** The system of material control on a continuous basis while the material is in storage is called *perpetual inventory system*. Under this system the actual stock is taken continuously and is compared with the stock as shown by the material records. It is a method of recording stores balance after every receipt and issue, to facilitate regular checking and to avoid closing down of factory for stock taking. According to ICMA, London, "perpetual inventory system is a system of records maintained by the controlling department which reflects the physical movement of stocks and their current balance". Thus it is a method of inventory control which enables to know the stock position of every item of material at all times. The basic objective of this system is to make available details regarding quantity and value of stock of each type of material at any time. This is made possible by verifying regularly the physical stock (actual stock) with the stock shown by material records.

An essential system of perpetual inventory is continuous physical stock taking. In other words continuous stock taking is a part of perpetual inventory system. Continuous stock taking involves physical verification of each item of stores by counting, measuring or weighing. This is done by independent internal audit staff. After ascertaining the physical (actual) stock, it is compared with stock as shown by material records. When the stock is incorrect, an enquiry is made and the discrepancies are adjusted in the records to make them correspond with the physical balance.

### **Procedure of Perpetual Inventory System**

The following procedure is followed for perpetual inventory system:

1. The material records should be made upto date to know the current balance of store.

2. The stores are selected in rotation for checking the items physically. Some items are taken up every day for verification. The programme is planned in such a way that in a year every item is checked three or four times.
3. The stores which have not yet been inspected should not be mixed with other stores.
4. There should be a surprise checking of every item. The storekeeper is informed of stock taking only on the day of checking.
5. After counting, weighting etc. the physical stock remaining in the store is recorded on sheets provided for the purpose.

### Advantages of Perpetual Inventory System

Perpetual inventory system has the following advantages:

1. It is not necessary to stop production (close factory) for stock taking at the end of the period.
2. Stock of each item of material (quantity and value) at any time is known.
3. It is possible to prepare interim final accounts as the value of stock is readily available.
4. Stock records are always kept up-to-date.
5. Pilferages and other material losses (e-g obsolescence) can be detected at an early stage.
6. It ensures a moral check on the stores staff. They work honestly keep their records up-to-date.
7. It helps in keeping the stock within the limits. It reduces overinvestment in materials.
8. It strengthens the system of internal control regarding materials. It exercises better and effective control over receipts, issues and balances both in quantity and value.
9. It provides correct and reliable information to the management regarding the daily balance of materials in quantity and value. This facilitates planning of purchases and production.
10. In case of destruction of stock by fire, the system helps in settling satisfactorily insurance claims as the correct value of stock is always known.

### JIT (Just In Time) Inventory Technique

JIT is a modern technique of inventory control. It was first used by

the Japanese Motor Company, Toyota. The system aims at minimising inventories of raw material and work-in-progress. It also aims at eliminating waste from every aspect of manufacturing and its related activities.

The term JIT refers to producing only what is needed, when it is needed, in just the quantity needed. According to CIMA Terminology, "JIT is a technique for the organisation of workflows, to allow rapid, high quality, flexible production whilst minimising manufacturing waste and stock level". It is a highly integrated production, sales and distribution system leading to continuous flow to produce the kinds of units needed at the time needed and in quantities needed. In the words of Fujio Cho of Toyota, "JIT is anything other than the minimum amount of equipment, materials, parts, space and worker's time, which are absolutely essential to add value to the product".

There are two aspects to JIT - JIT production and JIT purchasing. JIT production is "a system which is driven by demand for finished products, whereby each component on a production line is produced only when needed for the next stage". The aim is to produce the required items of high quality exactly at the time they are required. Under JIT purchasing, a company makes arrangement with supplier to deliver materials just before they are needed in the production process. For this the company must build up close working relationships with fewer suppliers.

### **Objectives of JIT**

1. To reduce set up time and load time
2. To reduce inventories
3. To increase flexibility
4. To shorten the reaction time to the customer
5. To eliminate over-production
6. To improve space utilisation
7. To provide customer satisfaction

### **Advantages of JIT**

Through JIT it is possible to make large savings. Much lower investment is required to hold inventory. When inventory levels are reduced from three months to one month of sales, financial costs are reduced by two-thirds. As a result of these, storage costs will be reduced. It is possible

to develop a balanced production system that is flexible and allows for smooth, rapid flow of materials. Some companies report 90% reductions in production lead time, 90% reduction in work-in-progress and 80% reduction in space required for production. This technique is one component in the zero working capital concept. The benefits of JIT are summarised as follows:

1. Reduction in inventory and optimum utilisation of working capital.
2. Quality improvement
3. Increased productivity
4. Elimination of waste
5. Reduction in storage costs resulting from space savings and improved layout
6. Increased profit margin
7. Greater customer satisfaction resulting from higher quality, better deliveries and greater product variety

The main advantage of JIT is that it helps to reduce the inventory levels.

### **Role of Financial Manager in Inventory Management**

The financial manager should be aware of the advantages and disadvantages associated with high level and low level of inventories. He can arrive at optimum level of inventory by using various tools and techniques. For this he can apply EOQ model. It helps in determining the optimum size of the order. But it does not indicate the time to order. On the basis of past experience, the financial manager can estimate the time usually taken by suppliers to deliver the inventories after placement of order (i.e. lead time). By using lead-time and safety stock, re-order level can be ascertained. For maintaining inventories he will apply ABC analysis. He has to find out whether materials are slow moving. For this, he can use inventory turnover ratio and aging schedule of inventories.

### **PRACTICAL PROBLEMS**

#### **Illustration 1**

The annual demand for a product is 6,400 units. The unit cost is Rs. 6 and inventory carrying cost per unit per annum is 25% of the average inventory cost. If the cost of procurement is Rs. 75, determine:

- (a) Economic order quantity (EOQ)  
 (b) Number of orders per annum; and  
 (c) Time between two consecutive orders.

**Solution**

$$(a) \text{ EOQ} = \sqrt{\frac{2CO}{I}}$$

where, C = Annual consumption in units = 6,400 units

O = Cost of placing an order = Rs. 75

I = Inventory carrying cost of one unit =  $6 \times 25/100 = \text{Rs. } 1.50$

$$\begin{aligned} \text{EOQ} &= \sqrt{\frac{2 \times 6,400 \times 75}{1.50}} \\ &= \sqrt{\frac{9,60,000}{1.50}} \\ &= \sqrt{6,40,000} = 800 \text{ units} \end{aligned}$$

$$(b) \text{ Number of orders per annum} = \frac{6,400}{800} = 8 \text{ orders}$$

$$(c) \text{ Time between two consecutive orders} = \frac{12 \text{ months}}{8 \text{ orders}} = 1.5 \text{ months}$$

**Illustration 2**

Assume that the following quantity discount schedule, for a particular bearing, is available to a retail store:

Order size (units)

Discount

**Illustration 4**

Surya Ltd manufactures picture tubes for TV. The following are the details of their operations during 2005 – 2006

Ordering cost	Rs. 100 per order
Inventory carrying cost	20% p.a.
Cost of tubes	Rs. 500 per tube
Normal usage	100 tubes per week
Minimum usage	50 tubes
Maximum usage	200 tubes per week
Lead time to supply	6 – 8 weeks

Required:

- (i) Economic order quantity. If the supplier is willing to supply 1,500 units at a discount of 5%, is it worth accepting?
- (ii) Re-order level. (iii) Maximum level. (iv) Minimum level.

**Solution**

(i) Economic Order Quantity (EOQ) =  $\sqrt{\frac{2CO}{I}}$

where, C = Annual consumption = 100 x 52 = 5,200 units

O = Cost of placing an order = Rs. 100

I = Inventory carrying cost of one unit = 500 x 20/100 = Rs. 100

$$EOQ = \sqrt{\frac{2 \times 5,200 \times 100}{100}}$$

$$= \sqrt{10,400} = 102 \text{ tubes approximately.}$$

*Comparative Cost of EOQ and 1,500 units at a discount of 5%*

	EOQ 102 units (Rs.)	1,500 units (Rs.)
Cost of tubes (5,200 x 500) and (5,200 x 475)	26,00,000	24,70,000
$\left[ \begin{array}{c} 5,200 \\ \times 100 \end{array} \right]$ and $\left[ \begin{array}{c} 5,200 \\ \times 100 \end{array} \right]$	5,100	400