

Working Notes:

$$\begin{aligned}
 U &= \text{Annual demand of input units for 12,000 units of ZED.} \\
 &= 52 \text{ weeks} \times \text{Normal usage of input units per week.} \\
 &= 52 \text{ weeks} \times 50 \text{ units of input per week} \\
 &= 2,600 \text{ units}
 \end{aligned}$$

Example 3.17

A company uses three raw materials A, B and C for a particular product for which the following data apply:

Raw material	Usage per unit of product (kg)	Re-order quantity (kg)	Price per kg	Delivery (in weeks)			Re-order level (kg)	Minimum level (kg)
				Min.	Av.	Max.		
A	10	10,000	0.10	1	2	3	8,000	
B	4	5,000	0.30	3	4	5	4,750	
C	6	10,000	0.15	2	3	4		2,000

Weekly production varies from 175 to 225 units, averaging 200 units of the said product. What would be the following quantities:

- (i) Minimum stock of A?
- (ii) Maximum stock of B?
- (iii) Re-order level of C?
- (iv) Average stock level of A?

Solution:

- (i) *Minimum stock of A*

$$\begin{aligned}
 &\text{Re-order level} - (\text{Average rate of consumption} \times \text{Average time required to obtain fresh delivery}) \\
 &= 8,000 - (2,000 \times 2) = 4,000 \text{ kg}
 \end{aligned}$$

- (ii) *Maximum stock of B*

$$\begin{aligned}
 &\text{Re-order level} - (\text{Minimum consumption} \times \text{Minimum re-order period} + \text{Re-order quantity}) \\
 &= 4,750 - (4 \times 175 \times 3) + 5,000 \\
 &= 9,750 - 2,100 = 7,650 \text{ kg}
 \end{aligned}$$

- (iii) *Re-order level of C*

$$\text{Maximum re-order period} \times \text{Maximum usage} = 4 \times 1,350 = 5,400 \text{ kg}$$

or

$$\begin{aligned}
 &\text{Re-order level of C} = \text{Minimum stock of C} + (\text{Average rate of consumption} \times \text{Average time required to obtain fresh delivery}) \\
 &= 2,000 + [200 \times 6 \times 3] \text{ kg} = 5,600 \text{ kg}
 \end{aligned}$$

- (iv) *Average stock level of A*

$$\begin{aligned}
 &= \frac{\text{Minimum stock} + \text{Maximum stock}}{2} = \frac{4,000 + 16,250}{2} \\
 &= 10,125 \text{ kg}
 \end{aligned}$$

Working Note:

$$\begin{aligned}\text{Maximum stock of } A &= ROL + ROQ - (\text{Min. consumption} \times \text{Min. re-order period}) \\ &= 8000 \text{ kg} + 10000 - [(175 \times 10) \times 1] \\ &= 16250 \text{ kg}\end{aligned}$$

Example 3.18

A Ltd. is committed to supply 24,000 bearings per annum to B Ltd. on a steady basis. It is estimated that it costs 10 paise as inventory holding cost per bearing per month and that the set-up cost per run of bearing manufacture is Rs. 324.

- (i) What should be the optimum run size for bearing manufacture?
- (ii) What would be the interval between two consecutive optimum runs?
- (iii) Find out the minimum inventory cost per annum.

(CA Inter, Nov. 2000)

Solution:

- (i)
- Optimum run size for bearing manufacture*

$$\begin{aligned}&= \sqrt{\frac{2 \times \text{Annual supply of bearings} \times \text{Set-up cost per production run}}{\text{Annual holding cost per bearing}}} \\ &= \sqrt{\frac{2 \times 24,000 \text{ bearings} \times \text{Rs. } 324}{12 \text{ months} \times 0.10 \text{ P.}}} = \sqrt{12960000} \\ &= 3600 \text{ bearings}\end{aligned}$$

- (ii)
- Interval between two consecutive optimum runs*

$$\begin{aligned}&= \frac{12 \text{ months}}{\text{Number of production runs per annum}} = \frac{12 \text{ months}}{\left(\frac{\text{Annual production}}{\text{Optimum run size}}\right)} \\ &= \frac{12 \text{ months}}{\left(\frac{24,000 \text{ bearings}}{3,600 \text{ bearings}}\right)} = \frac{12 \text{ months}}{6.66} \\ &= 1.8 \text{ months or } 55 \text{ days approximately}\end{aligned}$$

- (iii)
- Minimum inventory cost per annum*

$$\begin{aligned}&= \text{Total production run cost} + \text{Total carrying cost per annum} \\ &= \frac{24,000 \text{ bearings}}{3,600 \text{ bearings}} \times \text{Rs. } 324 + (1/2) 3,600 \text{ bearings} \times 0.10 \text{ P} \times 12 \text{ months} \\ &= \text{Rs. } 2,160 + \text{Rs. } 2,160 \\ &= \text{Rs. } 4,320\end{aligned}$$

Example 3.19

A manufacturer requires 9,600 units of a certain component annually. This is currently purchased from a regular supplier at Rs. 50 per unit. The cost of placing an order is Rs. 60 per order and the annual carrying cost is Rs. 5 per piece. What is the economic order quantity (EOQ) for placing order?

Recently the supplier has expressed his willingness to reduce the price to Rs. 48, if the total requirements are obtained from him in two equal orders and to Rs. 47, if the entire quantity required is purchased in one lot. Analyse the cost of the three options and recommend the best course.

What other factors should also be considered before the decision is taken?

(I.C.W.A., Inter Stage I, Dec. 2003)

Solution:

Economic Order Quantity (EOQ)

$$= \sqrt{\frac{2 \times \text{Annual Consumption} \times \text{Cost of placing an order}}{\text{Cost of carrying one unit inventory for one year}}}$$

$$= \sqrt{\frac{2 \times 9600 \times 60}{5}} = \sqrt{230400} = 480 \text{ units}$$

Analysis of Costs of three options

No. of order (options)	20	2	1
Size of order (units)	480	4800	9600
Price per unit of components (Rs.)	50	48	47
Average stock (units)	240	2400	4800
Total ordering Cost (Rs.) @ Rs. 60	1200	120	60
Total carrying cost (Rs.) @ Rs. 5	1200	12000	24000
Total cost of components (Rs.)	480000	460800	451200
Grand total cost (annual)	482400	472920	475260

Recommendation: From the above analysis it reveals that the most economical order quantity is 4800 units of components. Therefore placing 2 orders is marginally best.

Other factors to be considered are as follows:

- availability of sufficient storage space
- possible deterioration in quality due to long storage
- opportunity cost of funds required for investment in the inventory.

Total cost of components = No. of orders × Size of order (units) × Price per unit of component (Rs.)

Example 3.20

RST Limited has received an offer of quantity discount on its order of materials as under:

Price per tonne	Tonnes number
Rs. 9,600	Less than 50
Rs. 9,360	50 and less than 100
Rs. 9,120	100 and less than 200
Rs. 8,880	200 and less than 300
Rs. 8,640	300 and above

The annual requirement for the material is 500 tonnes. The ordering cost per order is Rs. 12,500 and the stock holding cost is estimated at 25% of the material cost per annum.

Required:

- Compute the most economical purchase level.
- Computer EOQ if there are no quantity discounts and the price per tonne is Rs. 10,500.

(CA, PE, Exam II, Group II, Nov. 2004)

Solution:

(i)

Order size (Q units)	No. of orders	Cost of purchase (AQ × per unit cost)	Ordering cost No. of orders × Rs. 12500	Carrying cost 2 × C × 25%	Total cost (3+4+5)
(1)	(2)	(3)	(4)	(5)	(6)
40	12.5	48,00,000 (500 × 9600)	1,56,250	48,000 $\left(\frac{40}{2} \times 9600 \times 0.25\right)$	50,04,250
50	10	46,80,000 (500 × 9360)	1,25,000	58,500 $\left(\frac{50}{2} \times 9360 \times 0.25\right)$	48,63,500
100	5	45,60,000 (500 × 9120)	62,500	1,14,000 $\left(\frac{100}{2} \times 9120 \times 0.25\right)$	47,36,500
200	2.5	44,40,000 (500 × 8880)	31,250 (2.5 × 12500)	2,22,000 $\left(\frac{200}{2} \times 8880 \times 0.25\right)$	46,93,250
300	1.67	43,20,000 (500 × 8640)	20,875 (1.67 × 12500)	3,24,000 $\left(\frac{300}{2} \times 8640 \times 0.25\right)$	46,64,875

The above table shows that the total cost of 500 units including ordering and carrying cost is minimum (Rs. 46,64,875) where the order size is 300 units. Hence the most economical purchase level is 300 units.

$$(ii) EOQ = \sqrt{\frac{2AO}{c \times i}} = \sqrt{\frac{2 \times 500 \times 12500}{10500 \times 25\%}} = 69 \text{ tonnes.}$$

Example 3.21

IPL Limited uses a small casting in one of its finished products. The castings are purchased from a foundry. IPL Limited purchases 54,000 castings per year at a cost of Rs. 800 per casting.

The castings are used evenly throughout the year in the production process on a 360-day-per-year basis. The company estimates that it costs Rs. 9,000 to place a single purchase order and about Rs. 300 to carry one casting in inventory for a year. The high carrying costs result from the need to keep the castings in carefully controlled temperature and humidity conditions, and from the high cost of insurance.

Delivery from the foundry generally takes 6 days, but it can take as much as 10 days. The days of delivery time and percentage of their occurrence are shown in the following tabulation:

Delivery time (days)	:	6	7	8	9	10
Percentage of occurrence	:	75	10	5	5	5

Required:

- Compute the economic order quantity (EOQ).
- Assume the company is willing to assume a 15% risk of being out of stock. What would be the safety stock? The re-order point?

- (iii) Assume the company is willing to assume a 5% risk of being out of stock. What would be the safety stock? The re-order point?
- (iv) Assume 5% stock-out risk. What would be the total cost of ordering and carrying inventory for one year?
- (v) Refer to the original data. Assume that using process re-engineering the company reduces its cost of placing a purchase order to only Rs. 600. In addition company estimates that when the waste and inefficiency caused by inventories are considered, the true cost of carrying a unit in stock is Rs. 720 per year.
- (a) Compute the new *EOQ*.
- (b) How frequently would the company be placing an order, as compared to the old purchasing policy?

(CA, PE, Exam II, Group II, May 2004)

Solution:

- (i) *Computation of economic order quantity (EOQ)*

(A) Annual requirement	= 54,000 castings
(B) Cost per casting	= Rs. 800
(O) Ordering cost	= Rs. 9,000/order
(c × i) Carrying cost per casting p.a	= Rs. 300

$$EOQ = \sqrt{\frac{2AO}{c \times i}} = \sqrt{\frac{2 \times 54000 \times 9000}{300}} = 1800 \text{ casting}$$

- (ii) *Safety stock*

(Assuming a 15% risk of being out of stock)

Safety stock for one day	= 54,000/360 days	= 150 castings
Re-order point	= Minimum stock level + Average lead time	
	× Average consumption	
	= 150 + 6 × 150 = 1,050 castings.	

- (iii) *Safety stock*

(Assuming a 5% risk of being out of stock)

Safety stock for three days	= 150 × 3 days	= 450 castings
Re-order point	= 450 casting + 900 castings	= 1,350 castings
(iv) Total cost of ordering	= (54,000/1,800) × Rs. 9,000	= Rs. 2,27,000
Total cost of carrying	= (450 + 1/2 × 1,800) Rs. 300	= Rs. 4,05,000

- (v) (a) *Computation of new EOQ:*

$$EOQ = \sqrt{\frac{2 \times 54,000 \times 600}{720}} = 300 \text{ castings}$$

- (b) Total number of orders to be placed in a year are 180. Each order is to be placed after 2 days (1 year = 360 days). Under old purchasing policy each order is placed after 12 days.

Example 3.22

The Complete Gardener is deciding on the economic order quantity for two brands of lawn fertilizer: Super Grow and Nature's Own. The following information is collected.

	Fertilizer	
	Super Grow	Nature's Own
Annual Demand	2,000 Bags	1,280 Bags
Relevant ordering cost per purchase order	Rs. 1,200	Rs. 1,400
Annual relevant carrying cost per bag	Rs. 480	Rs. 650

Required:

- Computer *EOQ* for Super Grow and Nature's Own.
- For the *EOQ*, what is the sum of the total annual relevant ordering costs and total annual relevant costs for Super Grow and Nature's Own?
- For the *EOQ*, compute the number of deliveries per year for Super Grow and Nature's Own.

(CA, PE, Exam II, Group II, Nov. 1999)

Solution:

$$(i) \text{EOQ} = \sqrt{\frac{2SC_0^*}{iC_1}}$$

*Here S = Annual demand of fertilizer bags.

C_0 = Cost per bag.

C = Relevant ordering cost per purchase order

iC_1 = Annual relevant carrying cost per bag

EOQ for Super Grow Fertilizer

$$\sqrt{\frac{2 \times 2,000 \text{ bags} \times \text{Rs. } 1,200}{\text{Rs. } 480}} = 100 \text{ bags.}$$

EOQ for Nature's Own Fertilizer

$$\sqrt{\frac{2 \times 1,280 \text{ bags} \times \text{Rs. } 1,400}{\text{Rs. } 650}} = 80 \text{ bags.}$$

(ii) *Total annual relevant costs for Super Grow Fertilizer*

= Total annual relevant ordering costs + Total annual relevant carrying costs

$$= \frac{S}{\text{EOQ}} C_0 + \frac{1}{2} \text{EOQ} \times iC_1$$

$$= \frac{2,000 \text{ bags}}{100 \text{ bags}} \text{Rs. } 1,200 + \frac{1}{2} 100 \text{ bags} \times \text{Rs. } 480$$

$$= \text{Rs. } 24,000 + \text{Rs. } 24,000 = \text{Rs. } 48,000$$

Total annual relevant costs for Nature's Own Fertilizer

$$= \frac{1,280 \text{ bags}}{80 \text{ bags}} \times \text{Rs. } 1,400 + \frac{1}{2} 80 \text{ bags} \times \text{Rs. } 650$$

$$= \text{Rs. } 22,400 + \text{Rs. } 22,400 = \text{Rs. } 44,800$$

(iii) *Number of deliveries for Super Grow Fertilizer per year.*

$$= \frac{S}{\text{EOQ}} \text{ (annual demand of fertilizer bags)}$$

$$= \frac{2,000 \text{ bags}}{100 \text{ bags}} = 20 \text{ orders}$$

Numbers of deliveries for Nature's Own fertilizers per year.

$$= \frac{1,280 \text{ bags}}{80 \text{ bags}} = 16 \text{ orders}$$

Example 3.23

A company manufactures 5,000 units of a product per month. The cost of placing an order is Rs. 100. The purchase price of the raw material is Rs. 10 per kg. The reorder period is 4 to 8 weeks. The consumption of raw materials varies from 100 kg to 450 kg per week; the average consumption being 275 kg. The carrying cost of inventory is 20% per annum. You are required to calculate reorder quantity, maximum level, minimum level and average level.

[B.Com. (Hons), Delhi, 2006, CA, PE Exam. II, Nov. 2002]

Solution:

$$\text{Re-order Quantity} = \sqrt{\frac{2 \times U \times P}{S}}$$

where

U = Annual usage

P = Cost of placing an order

S = Cost of storage one unit per annum

$U = 5,000 \times 12 = 60,000$; $P = 100$; $S = 20\% \text{ of } 10 = 2$

$$\begin{aligned} \therefore \text{Re-order Quantity} &= \sqrt{\frac{2 \times 60,000 \times 100}{2}} \\ &= 2449.48 \text{ or } 2450 \text{ (approx)} \end{aligned}$$

Re-order level: Maximum usage \times Maximum Re-order period
 $= 450 \times 8 = 3600$

Maximum level = Re-order level + Re-order quantity – (Minimum usage \times Minimum Re-order period)
 $= 3600 + 2450 - (100 \times 4) = 5650$

Minimum level = Re order level – (Average usage \times Average Re-order Period)
 $= 3600 - (275 \times 6) = 1950$

$$\begin{aligned} \text{Average level} &= \frac{\text{Maximum level} + \text{Minimum level}}{2} \\ &= \frac{5650 + 1950}{2} = 3800 \end{aligned}$$

or

$$\begin{aligned} \text{Average level} &= \text{Minimum level} + 1/2 \text{ Re-order quantity} \\ &= 1950 + 1/2 \times 2450 = 3175 \end{aligned}$$

Example 3.24

For the manufacture of a certain product two components A and B are used. The following particulars about these components are available:

	<i>A</i>	<i>B</i>
Normal usage (per week)	60 nos.	60 nos.
Maximum usage (per week)	80 nos.	80 nos.
Minimum usage (per week)	30 nos.	30 nos.
Reorder quantity	400 nos.	600 nos.
Reorder period	4 to 6 weeks	2 to 4 weeks

You are required to calculate for each component:

- (i) Reordering level;
- (ii) Minimum level;
- (iii) Maximum level;
- (iv) Average stock level.

(I.C.W.A, Inter, Stage 1, June 2004)

Solution:

- (i) *Reordering level*

(Maximum usage × Maximum Reorder period)

$$A = 80 \times 6 = 480$$

$$B = 80 \times 4 = 320$$

- (ii) *Minimum level*

Re-order level-(Normal usage × Normal re-order period)

$$A = 480 - (60 \times 5) = 180$$

$$B = 320 - (60 \times 3) = 140$$

- (iii) *Maximum level*

(Re-order level + Re-order qty.) - (Min. usage × Min. re-order period)

$$A = 480 + 400 - 30 \times 4 = 760$$

$$B = 320 + 600 - 30 \times 2 = 860$$

- (iv) *Average Stock Level*

(Minimum level + Maximum level)/2

$$A = (180 + 760)/2 = 470$$

$$B = (140 + 860)/2 = 500$$

Alternative:

Average stock level:

Minimum level + (Re-order quantity)/2

$$A = 180 + (400/2) = 380 \text{ units.}$$

$$B = 140 + (600/2) = 440 \text{ units.}$$

Example 3.25

The quarterly production of a company's product which has a steady market is 20,000 units. Each unit of a product requires 0.5 kg of raw material. The cost of placing one order for raw material is Rs. 100 and the inventory carrying cost is Rs. 2 per annum. The lead time for procurement of raw material is 36 days and a safety stock of 1,000 kg of raw materials is maintained by the company. The company has been able to negotiate the following discount structure with the raw material supplier.

<i>Order quantity</i>	<i>Discount</i>
kg.	Rs.
Upto 6,000	Nil
6,000 – 8,000	400

8,000 – 16,000	2,000
16,000 – 30,000	3,200
30,000 – 45,000	4,000

You are required to

- Calculate the re-order point taking 30 days in a month.
- Prepare a statement showing the total cost of procurement and storage of raw material after considering the discount of the company elects to place one, two, four or six orders in the year.
- State the number of orders which the company should place to minimize the costs after taking *EOQ* also into consideration.

(CA, PE, Exam II, Group II, May 2002)

Solution:

1. Annual production (units) (20,000 units per quarter × 4 quarters)	80,000
2. Raw material required for 80,000 units in kg (80,000 units × 0.5 kg)	40,000
3. $EOQ = \sqrt{\frac{2 \times 40,000 \text{ kg} \times \text{Rs. } 100}{\text{Rs. } 2}} = 2,000 \text{ kg}$	
4. Total cost of procurement and storage when the order size is equal to <i>EOQ</i> or 2,000 kg	
No. of orders (40,000 kg/2,000 kg)	20
Ordering cost (Rs.) (20 orders × Rs. 100)	2,000
Carrying cost (Rs.) (1/2 × 2,000 kg × Rs. 2)	2,000
Total cost	4,000

- (i) *Re-order point* = Lead time consumption + Safety stock
= 4,000 kg + 1,000 kg = 5,000 kg
(40,000 kg/360 days) × 36 days.

- (ii) **Statement showing the total cost of procurement and storage of raw materials**
(after considering the discount)

Order size	No. of orders	Total cost of procurement	Average stock	Total cost of storage of raw materials	Discount	Total cost
kg		Rs.	kg	Rs.	Rs.	Rs.
(1)	(2)	(3) = (2) × Rs. 100	(4) = 1/2 (1)	(5) = (4) × Rs. 2	(6)	(7) = [(3) + (5)] - (6)
40,000	1	100	20,000	40,000	4,000	36,100
20,000	2	200	10,000	20,000	3,200	17,000
10,000	4	400	5,000	10,000	2,000	8,400
6666.66	6	600	3,333	6,666	400	6,866

- (iii) Number of orders which the company should place to minimize the costs after taking *EOQ* also into consideration is 20 orders, each of size 2,000 kg. The total cost of procurement and storage in this case comes to Rs. 4,000, which is minimum.

STORES ORGANISATION

Efficient storing—after efficient purchasing—is another important step in materials control system.

The storekeeper and persons working in stores are primarily responsible for safeguarding the materials and keeping materials and supplies in proper places until required in production. It is difficult to list out all the functions performed by stores in different organisations. But usually they perform the following functions:

1. Acting as a buffer or protection against the consequences of non-availability.
2. Acting as a link between bulk purchases and the breaking down into units of need.
3. Providing security.
4. Avoiding damage and deterioration.
5. Establishing a proper system for ensuring control over usage, through a discipline of authority for withdrawals, formalised rationing of materials issued, recording of data for control, etc.
6. Marshalling during the course of manufacture.
7. Performing checking function on work done.
8. Serving as a means of reducing cost in movement of materials through systematic location, economy of handling, etc.
9. Forming a basis for good housekeeping, discipline and control.

Storage brings a sense of tidiness and good arrangements and help to emphasise the importance of responsibility and accountability.

Storage Layout

Storage layout, i.e. careful design and arrangement of storerooms is desirable for savings in cost. Materials can be stored according to: (i) account number specially given for different types of materials; (ii) the frequency of use of the item; (iii) the production area where the item is used; or (iv) the nature, size and shape of the item. Practically, no single one of these factors could be the sole basis for deciding the storing arrangement, but shape and size of the materials significantly influence storeroom arrangement.

The basic accounting records of any inventory system are the documents required to authorise and record materials movement into or out of the stores. These are the goods received note, materials requisition and materials return note. Stores ledger cards—stock ledger cards or materials ledger cards—may show quantities on order, expected delivery dates and quantities reserved or required for work due to be processed (Fig. 3.6).

ABC Company Limited Stores Ledger Card

Description _____	Code _____
Unit _____	Location _____
Maximum _____	Minimum _____
Re-order level _____	Re-order Quantity _____

<i>Receipt</i>			<i>Issues</i>			<i>Physical Balance</i>	<i>Reserved</i>			<i>Ordered</i>			<i>Free Balance</i>
<i>Date</i>	<i>Ref.</i>	<i>Qty.</i>	<i>Date</i>	<i>Ref.</i>	<i>Qty.</i>		<i>Date</i>	<i>Ref.</i>	<i>Cum Qty.</i>	<i>Date</i>	<i>Ref.</i>	<i>Cum Qty.</i>	

Fig. 3.6 Stores Ledger Card

Bin card Bin cards usually show quantities of each type of material received, issued and on hand. The bin card is placed in the bin or shelf or is hung over the almirah or the rack otherwise known as bin. Separate bin cards are prepared for each item of stores and if two different materials are kept in one almirah, two bin cards, one of each, are prepared, treating the almirah as two bins. A physical bin cards is presented in Fig. 3.7.

**ABC Company Limited
Bin Card**

Description _____ Bin No. _____
Store ledger No. _____ Code No. _____
Minimum level _____ Unit No. _____

Date	Received		Issue		Balance	
	Ref.	Qty.	Ref.	Qty.	Quantity	Check
May 1, 2008					500	
May 15, 2008		200			700	
May 30, 2008				300	400	
June 7, 2008		150			550	
June 25, 2008				400	150	

Fig. 3.7 Bin Card with Sample Data

Classification and Codification of Materials

Classification and codification of materials facilitates prompt identification of the materials in storage or when they are being issued to production departments. All items in the stores department should be properly classified and codified. Codification implies giving some symbols through letters or figures under a proper codification system. Codification provides certain benefits: (i) Simplicity in identifying and tracing the stores. (ii) Full particulars need not be given and thus clerical labour and time are saved. (iii) Secrecy is maintained about the details of the stores and all employees may not know them. (iv) Codification is necessary to adopt a mechanical system of accounting.

Issue of Materials

It is the quality of every good system of materials control that no materials can be issued from storerooms except on properly prepared and approved materials requisitions or stores requisitions. The materials requisition is a written order to the storekeeper to deliver materials or supplies to the place and the department designated or to give the materials to the person presenting a properly executed requisition. The materials requisition note (see Fig. 3.8) includes date, requisition number, department charged, name of stock ledger account to be credited, description of materials, quantity, unit price, total value, delivery point, signature of the person requisitioning the material and signature of the department executive approving the request for material. The requisitions are prepared in triplicate, one copy is retained by the preparer and two are sent to the storekeeper.

Department having standard materials requirements or a comparatively fixed list of materials or supplies generally use a special form of materials requisition called the "bill of materials". The bill of materials is a printed or duplicated form listing all the materials and part necessary for a typical job or production (see Fig. 3.9). In preparing such a requisition, it is necessary only to indicate the quantity in the blank space in front of the name or symbol of the material required.

**ABC Company Limited
Materials Requisition Note**

Job No. _____ Serial No. _____
Date _____

<i>Code No.</i>	<i>Description</i>	<i>Qty or Weight</i>	<i>Rate</i>	<i>Unit</i>	<i>Cost office Amount Stores</i>
					<i>ledger</i>

Authorised by _____ Storekeeper _____
Prices entered by _____ Received by _____
Bin Card entered _____ Calculation checked _____

Fig. 3.8 Materials Requisition Note

**ABC Company Limited
Bill of Material**

Job/work order No. _____ No. _____
Description of job _____ Date _____

<i>S. No.</i>	<i>Description</i>	<i>Code No.</i>	<i>Details of Issues</i>			<i>Remarks</i>
			<i>Date</i>	<i>Rate (Rs)</i>	<i>Amount (Rs)</i>	

Prepared by _____ Stores Department Cost Department
Checked by _____

Fig. 3.9 Bill of Material

Materials Returned to the Storeroom

Materials requisitioned from a storeroom and not needed or found to be defective are returned to the storeroom, where a returned material report is prepared either by the person returning the materials or by the storekeeper upon receipt of the materials. Two copies of the report are usually prepared; the original is used as a basis for crediting the accounts charged while the duplicate is retained in the files of the department returning the materials to the storeroom (Fig. 3.10).

Some departments may prefer to use the excess materials on the next job instead of returning them to the storeroom. But it is always advisable to prepare a returned materials report, otherwise one job will be charged unnecessarily with too much materials cost and the other job with too little. A materials transfer note (see Fig. 3.11) is prepared to transfer costs from one original job to the new job and also the transfer is noted in the stock records.

**ABC Company Limited
Material Return Note**

Issuing Department _____ No. _____
Job No. _____ Date _____

<i>S.No.</i>	<i>Description</i>	<i>Code No.</i>	<i>Quantity</i>	<i>Rate (Rs)</i>	<i>Amount (Rs)</i>
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Signature of
Works Manager/Foreman

Fig. 3.10 Material Return Note

**ABC Company Limited
Materials Transfer Note**

Serial No. _____
Date _____

The following materials have been transferred:
from Job No. _____

to Job No. _____

<i>Code</i>	<i>Description</i>	<i>Quantity</i>	<i>Cost Office</i>		
			<i>Rate</i>	<i>Unit</i>	<i>Amount</i>

Authorised	Delivered	Received	Priced
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Fig. 3.11 Materials Transfer Note

Materials Returned to Supplier

It may be necessary to return any rejected, specified excess, damaged or unsatisfactory materials to the supplier. Since goods are returned after having been received in storerooms and entered in the stock ledger

accounts, some correcting entries are required. From the reject/despatch note issued by the purchasing department, information regarding the quantity and value may be entered in the Received Section of the stock ledger accounts in red ink. Alternatively, an entry can be made in the Issued Section with a special notation or symbol to indicate that the goods were returned to the supplier and not issued to departments or jobs or processes.

INVENTORY SYSTEMS

There are two principal ways of accounting for inventories:

Perpetual Inventory System

The perpetual inventory method requires a continuous record of additions to or reductions in materials, work-in-progress, and cost of goods sold on a day-to-day basis. Physical inventory counts are usually taken at least once a year in order to check on the validity of the accounting records. The Institute of Cost and Management Accountant (U.K.) has defined perpetual inventory as:

A system of records maintained by the controlling department which reflects the physical movement of stocks and their current balance... A perpetual inventory is usually checked by a programme of continuous stocktaking, and the two terms are sometimes loosely considered synonymous. Perpetual inventory means the system of records, whereas continuous stocktaking means the physical checking of those records with actual stocks.

The perpetual inventory method has the following advantages:

1. The stock-taking task which is long and costly is avoided under this method.
2. The inventory of different items of materials in accordance with the stores ledger can be promptly prepared for the preparation of the income statement and balance sheet at interim periods if required without a physical inventory being taken.
3. Management may be informed daily of the number of units and the value of each kind of material on hand—information which tends to eliminate delays and stoppage in production.
4. The investment in materials and supplies may be kept at the lowest point in conformity with operating requirements.
5. A system of internal check is always in operation and the activities of different departments, such as purchasing, stores and production are continuously checked against each other.
6. It is not necessary to stop production so as to carry out a complete physical stock-taking.
7. Discrepancies and errors are promptly discovered and localised and remedial action can be taken to avoid their occurrence in the future.
8. This method has a moral effect on the staff, makes them disciplined and careful and acts as a check against dishonest actions.
9. The disadvantages of excessive stock are avoided, such as loss of interest on capital invested in stock, loss through deterioration, risk of obsolescence.

Periodic Inventory System

Under the periodic method, the entire book inventory is verified at a given date by an actual count of materials on hand. This physical inventory is usually taken near the end of the accounting period. This method provides for the recording of purchases, purchase returns and purchase allowances on a daily basis but does not provide for a continuous inventory or for a daily computation of the cost of goods sold. At the end of each accounting period, a physical count is made of the quantity of goods on hand and the value of the inventory is determined by using an inventory pricing method (FIFO, LIFO or Average Cost) and attaching cost to

units counted. The cost of goods sold is computed by deducting closing inventory from the sum of opening inventory and purchases made during the current period. It is assumed that goods not on hand at the end of accounting period have been sold. There is no system and accounting for shrinkage, losses, theft and waste throughout the accounting period and they can be discovered only after the end of the period.

It can be concluded that perpetual inventory assists management in planning future purchases, reduces possibilities of stock shortages and aids in the reduction of waste, spoilage, etc., associated with the storage of inventory. But it is also more costly of the two procedures. The periodic inventory procedure is simple in concept and application. Yet it normally requires the shutdown of operation while it is carried out; it is error-prone due to inexperience of inventory takers; it cannot pinpoint shortages resulting from theft or waste.

INVENTORY SHORTAGES (LOSSES) AND OVERAGES

Under the perpetual inventory system, inventory accounts are maintained up-to-date in a stores ledger. It is, however, necessary to make physical counts of the materials at regular intervals to compare with the stores ledger records. It is possible that physical counting of materials may not agree with the stores ledger. The difference may be because of the following reasons:

A. Unavoidable

1. Evaporation
2. Absorption, moisture
3. Temperature changes affecting the volume of stock
4. Shrinkage
5. Deterioration of quality in stores, for example, through rust
6. Loss due to breaking bulk or cutting up.

B. Avoidable

1. Pilferage
2. Unsuitable storage
3. Careless handling
4. Under and over issues
5. Materials unused but not returned to stores

INVENTORY CONTROL

Nature of Inventory

Inventory is stores of goods and stocks. The Institute of Chartered Accountants of India (Accounting Standards 2) defines inventories as:

“Tangible property held (i) for the sale in the ordinary course of business, or (ii) in the process of production for such sale, or (iii) for consumption in the production of goods or service for sale, including maintenance supplies and consumables other than machinery spares.”

In other words, in manufacturing organisations, inventories include (a) raw-materials, (b) work-in-progress, (c) finished produced goods, and (d) manufacturing supplies. In trading concerns, inventories consists of (a) merchandise held for sale, and (b) office, packing and other supplies.

Meaning of Inventory Control

Inventory control is the technique of maintaining inventory items (raw materials, work-in-progress, finished products, factory supplies) at desired levels. Manufacturing firms face several inventory control problems as

compared to service-oriented organisations. In manufacturing organisations, production is of some tangible physical product. Therefore, emphasis is given to control of all inventory items. In service organisations, the focus is on service, and therefore there is very little emphasis on inventory control. In such service firms, services are used (consumed) as they are generated and not stocked for future consumption. However, there are some service organisations, such as hospitals, military organisations, educational institutions which have to maintain inventories of items related to their nature of work.

Importance of Inventory Control

Inventory control is of great significance in almost all types of business enterprises. If inventories pile up due to over-production or slow demand, capital is tied up which cannot be used for other productive purposes. Alternatively, production is likely to suffer because of inadequate inventory on hand. As stated earlier in this chapter, the basic objective of inventory control is identical to materials control, that is, maintaining inventory of adequate size for uninterrupted production and lowest investment on the inventory in conformity with production requirements.

Inventory control is also necessary because of the following significant factors:

1. *Demand fluctuations* There are likely to be fluctuations in demand pattern. To cope with the changing consumers' demand, it is necessary that adequate inventory should be maintained.
2. *Uncertainty about lead time* Sometimes the supplier may take more time in supplying the raw materials than expected. During this additional time, inventory has to be maintained so that the production does not suffer.
3. *Avoiding over-stocking and under-stocking* Over-stocking and under-stocking both are undesirable and should be avoided.

Inventory Control Techniques

Different business concerns may apply different inventory control techniques to meet specific requirements and circumstances. However, the following techniques are commonly used by firms for inventory control:

1. Two-bin system—bag and tag system.
2. Order cycling system.
3. Determination of inventory levels.
4. Statistical control system.
5. Control ratios.
6. Reservation system.
7. Budgetary control system.
8. ABC classification and control method (Pareto Analysis)
9. Perpetual inventory system.
10. Just-In-Time-Method

Pareto or ABC Analysis

In a large manufacturing company where stocks of direct materials and component parts consist of many thousands of different items, companies find it useful to divide materials, parts, supplies and finished goods into sub-classifications for purposes of inventory control. Many business firms introduce a system of analysing stocks by value categories known as "ABC or Pareto Analysis". Under this method, inventory items are ranked according to investments in each item in the inventory. The large value items are grouped together into one class for inventory control purposes. The lowest value items are grouped into another class and those items which are of intermediate value are grouped into a "middle" classification. High value items are labelled "Class A", middle value items, "Class B", and low value items, "Class C". All items in stock are listed in order of descending values showing quantity held and the corresponding value of the materials (see Table 3.3).

The percentage given in Table 3.3 are only guidelines and are subject to change according to prevailing circumstances and choice of management. Table 3.3 shows that only 20% of the items represent 72% of the total costs.

Class	Items		Investment	
	No. of items	Per cent of total items	Total cost	Per cent of total
A	20,000	20%	2,88,000	72%
B	30,000	30%	76,000	19%
C	50,000	50%	36,000	9%
	100,000	100%	4,00,000	100%

The items under Class A are subject to greater continuous control and planning than are the items under other categories. The Class A items account for high annual consumption costs and correspondingly high investment in inventories. Because of high investments in Class A items, there would be frequent ordering and low safety stocks. This also assumes that the cost of placing and following up orders is relatively low in comparison with the costs of carrying excess inventories. A number of things can be done to reduce inventory of 'A' items. For example, A items can generally be ordered for specific runs, the economic order quantity could be applied; local suppliers could be asked to stock supplies so that delivery time can be shortened. On the other hand, where the total annual purchase cost is relatively low as in the case of Class C items, there will be less frequent ordering and higher safety stocks. Items in Class C receive the least amount of control and should be under simple physical controls such as the two-bin system with safety stocks.

A graph can be prepared to show quantity and amount of items in different categories in descending order of value (Fig. 3.12).

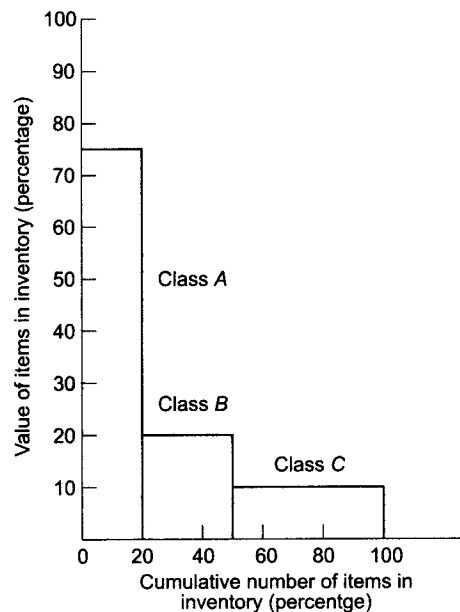


Fig. 3.12 ABC (Pareto) Method of Inventory Classifications

Example 3.26

A factory uses 4,000 varieties of inventory. In terms of inventory holding and inventory usage, the following information is compiled:

No. of varieties of inventory	%	% value of inventory holding (average)	% of inventory usage (in end product)
3875	96.875	20	5
110	2.75	30	10
15	0.375	50	85
	100.00	100	100

Classify the items of inventory as per ABC analysis with reasons.

(B.Com. (Hons), Delhi, 2003, CA, Inter Nov. 1998)

Solution:

Assume Rs. 10,00,000 as value of inventory of 4000 varieties in this factory.

No. of varieties of inventory (items)	% of varieties	% value of inventory holding (average)	value of inventory holding (average)	% of inventory usage (in end product)	Value of inventory usage (in end product)
3875	96.875	20	$\frac{10,00,000 \times 20}{100}$ = Rs. 2,00,000	5	$\frac{20,00,000 \times 5}{100}$ = Rs. 10,000
110	2.750	30	$\frac{10,00,000 \times 30}{100}$ = Rs. 3,00,000	10	$\frac{3,00,000 \times 10}{100}$ = Rs. 30,000
15	0.375	50	$\frac{10,00,000 \times 50}{100}$ = Rs. 5,00,000	85	$\frac{5,00,000 \times 85}{100}$ Rs. 4,75,000

Value of inventory items with 15% is Rs. 4,75,000 which is highest among the three varieties of inventory items.

Classification of the Items of Inventory as per ABC Analysis

Category A: 15 number of varieties of inventory items, should be classified as those of *A* category because of the following reasons:

- They constitute 0.375% of total number of varieties of inventory items handled by stores of factory. This is the minimum as per the given classification in the table.
- The total usage of these items is 50% of total use value of inventory holding (average) which is maximum according to the given table.
- The consumption of these items is about 85% of usage in end product.

Category B: 110 number of inventory items, should be classified as those of *B* category because of the following reasons:

- (i) They constitute 2.750% of total number of varieties of inventory items handled by the stores of the factory.
- (ii) They require moderate investment of about 30% of total use value of inventory holding (average).
- (iii) Their consumption is moderate about 10% of inventory usage in the end-product.

Category C: 3,875 number of varieties of inventory items, should be classified as those of category *C* because of the following reasons:

- (i) They constitute 96.875% of total varieties of inventory items handled by stores of factory.
- (ii) They require investment of 20% of total use value of average inventory holding.
- (iii) Their consumption is minimum that is, just 5% of inventory usage in end product.

Kanban

Kanban is a Japanese term which means display on instruction card. In a manufacturing or factory organisation, Kanban contains many information such as reorder point, lead time, delivery location, source of supply, part number, quantity of parts that should be possessed etc. It is a system of markers which authorises production and movement to the process which requires the parts.

Business firms can use Kanban or any other similar technique as a production control tool. The employees in the production department manufacture parts as per the details mentioned on the Kanban which is used like production card. If in a factory, there is no Kanban card, production may not be done and transfer of materials may not take place.

Kanban is highly useful if used with JIT. The JIT pull system means that components are not made until requested by the next process. This is normally done by monitoring parts consumption at each stage and using a system of Kanban. Kanban, therefore, will reduce inventory, decrease lead or supply time and finally will increase productivity through integrating different processes.

Just-In-Time (JIT) Method

Just-In-Time (JIT) is a purchasing and inventory control method in which materials are obtained just in time for production to provide finished goods just in time for sale. There are two aspects of JIT: (i) Just-In-Time (JIT) Production, and (ii) Just-In-Time (JIT) purchasing. JIT with regard to production means producing only what is needed, when it is needed, in the quantity just needed. A JIT manufacturing system requires making goods or services only when the customer, internal or external, requires it. According to CIMA Official Terminology:

“JIT is a technique for the organisation of work flows, to allow rapid, high quality, flexible production whilst minimising manufacturing waste and stock level”. Further, CIMA defines JIT production as “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.”

JIT purchasing requires better coordination with suppliers so that materials arrive immediately prior to their use. Firms using JIT purchasing enter into long term contracts with them to enable vendors to plan their annual production. Under JIT purchasing, *EOQ* is much lower as compared to *EOQ* under conventional purchasing. JIT purchasing provides significant savings in cost.

JIT aims to achieve the following objectives:

- (i) Zero inventory
- (ii) Zero breakdown
- (iii) 100% on time delivery service
- (iv) elimination of non-value added activities
- (v) Zero defects.

JIT is a demand-pull system. Demand for customer output (not plans for using input resources) triggers production. Production activities are “pulled” not “pushed” into action. The major differences between JIT manufacturing and traditional manufacturing are as follows:

<i>JIT</i>	<i>Traditional</i>
1. Pull system	1. Push system
2. Insignificant or Zero inventories	2. Significant inventories
3. Manufacturing cells (work centres)	3. Process structure
4. Multifunction labour	4. Specialised labour
5. Total quality management (TQM)	5. Acceptable quality level (AQL)
6. Simple cost accounting	6. Complex cost accounting

JIT production and JIT purchasing reduces or eliminates inventory and the costs associated with carrying the inventory. JIT emphasises that workers immediately correct the system making defective units because they have no inventory. With no inventory to draw from for delivery to customers, just-in-time relies on high quality materials and production. It is required that the companies that use just-in-time manufacturing must eliminate all the sources of failure in the system. Production people must be better trained so that they can carry out their works without errors. Suppliers must be able to produce and deliver defect free materials or components just when they are required, and equipment must be maintained so that machine failures are eliminated.

JIT applies to raw materials inventory as well as to work-in-process inventory. The goals are that both raw materials and work in progress inventory are held to absolute minimums. JIT is used to complement other materials planning and control tools, such as *EOQ* and safety stock levels. In JIT system, production of an item does not commence until the organisation receives an order. When an order is received for a finished product, production people give orders for raw materials. As soon as production is complete to fill the order, production ends. In theory, in JIT, there is no need for inventories because no production takes place until the organisation knows that it will sell them. In practice, however, companies using just in time inventory generally have a backlog of orders or stable demand for their products to assure continued production.

The fundamental objective of JIT is to produce and deliver what is needed, when it is needed, at all stages of the production process—just in time to be fabricated, sub-assembled, assembled, and despatched to the customer. Although in practice there are no such perfect plans, JIT is an ideal and therefore a worthy goal. The benefits are low inventory, high manufacturing cycle rates, high output per employee, minimum floor space requirements, minimum indirect labour, and perfect in-process control. An associated requirement of a successful JIT operation is the pursuit of perfect quality in order to reduce, to an absolute minimum, delays caused by defective product units.¹

INVENTORY TURNOVER

Business enterprises can analyse the turnover of different items of stock to find out which stocks are slow moving. Inventory turnover ratio enables the management to avoid capital being locked up in undesirable stocks. This ratio indicates the efficiency or inefficiency with which inventories are maintained. Inventory turnover ratio is calculated as follows:

1. Milton F. Usry and Lawrence H. Hammer, *Cost Accounting, Planning and Control*, Cincinnati: South Western Publishing Co., 1999, p. 257.

$$\frac{\text{Cost of materials consumed}}{\text{Cost of average stock held during the period}}$$

The cost of average stock here is taken as the average of opening and closing stock.
The stock turnover can also be calculated in days as below:

$$\frac{\text{Days during the period}}{\text{Inventory turnover ratio}}$$

Detection of Slow-moving and Non-moving or Obsolete Materials

It is essential for a business firm to detect slow-moving and non-moving or obsolete materials. Obsolete materials become useless or obsolete due to change in product, process, design or method of production. Obsolete materials are different from slow-moving materials. Slow-moving stocks move at a slow rate. In case of slow and non-moving materials, capital remains locked unnecessarily and also cost of storing continue to be incurred if these materials are stored in excess of the requirements. Management should make proper investigation into slow-moving and obsolete materials and take steps to minimise losses arising therefrom. Management should prepare regular reports to examine the situations relating to these stocks so that useless stocks could be disposed off or used in some profitable work and effective steps could be taken to increase the movement of slow moving stocks.

Example 3.27

Compute the materials turnover ratio for materials *A* and *B* and comment upon the results.

	Materials A (Rs.)	Materials B (Rs.)
Opening stock	10,000	35,000
Purchase during the year	76,000	50,000
Closing stock	6,000	25,000

Solution:

Cost of materials consumed:	Materials A	Materials B
Opening stock	10,000	35,000
Add: Purchases	76,000	50,000
	86,000	85,000
Less: Closing stock	6,000	25,000
Cost of materials consumed	80,000	60,000

Average stock held:	Materials A	Materials B
Opening stock	10,000	35,000
Closing stock	6,000	25,000
	16,000	60,000
	16,000÷2	60,000÷2
Average stock	8,000	30,000

Material turnover ratio

$$= \frac{\text{Cost of materials consumed}}{\text{Cost of stock held}}$$

$$\text{Materials } A = \frac{80,000}{8,000} = 10 : 1 \text{ or } 10$$

$$\text{Materials } B = \frac{60,000}{30,000} = 2 : 1 \text{ or } 2$$

Materials turnover in days

$$= \frac{\text{Days during the year}}{\text{Materials turnover ratio}}$$

$$\text{Materials } A = \frac{365}{10} = 36.5 \text{ days}$$

$$\text{Materials } B = \frac{365}{2} = 182.5 \text{ days}$$

From the above results, it can be said that materials *A* are very fast moving materials, while materials *B* are very slow moving when compared with materials *A*. Since, the normal standard inventory turnover ratio should be 2 : 1, the materials *B* turnover ratio can be said to be normal. Materials *A* turnover ratio is 36.5 days which shows that an average stock is being kept for 36.5 days. In contrast, materials *B* average stock is being kept for 182.5 days. Therefore, materials *B* are slow-moving materials.

ACCOUNTING FOR MATERIAL LOSSES

Some materials losses are bound to occur during manufacturing operations because of the nature of the raw materials or other factors which reduce the expected production. These losses may be waste, scrap, spoilage, defective.

Scrap

Scrap is residue from manufacturing operations that has measurable but relatively minor recovery value. Scrap is saleable material resulting from the primary manufacturing operations. Scrap results from: (i) the processing of materials, (ii) defective and broken parts, (iii) obsolete stock, revisions or abandonment of experimental projects, and scrapping of worn out or obsolete machinery. In some cases scrap can be sold and should therefore be collected and placed in storage so that it can be sold to scrap dealers. Scrap should be accounted for in some manner not only from the point of view of efficiency, but because scrap is often a tempting source of theft.

Treatment of Scrap

Scrap may be treated in the cost accounts in the following ways:

1. Where the value of scrap is very insignificant, it is not considered in the cost accounts. That is, the cost of scrap is charged to good units and income from the sale of scrap is treated as other income.
2. If the value of scrap is significant, the net sale proceeds of scrap (sales value of scrap—cost of selling the scrap) is deducted from the material cost. That is, the amount (net) realised from the sale is treated as a reduction in the materials cost that has been charged to the individual job or product.
3. The scrap may be sold in a period different from that in which it was created and if the scrap has a low sales value, only a quantity record of the scrap should be maintained. It is not valued and does not appear on the balance sheet.

Scrap Report

It is advisable to prepare a daily, weekly, scrap report to account for scrap and to compare it with predetermined norms or standards which, in turn, can reveal unexpected items and unusual amounts. A specimen of scrap report is given in Fig. 3.13.

<i>Production Department</i>			<i>Scrap Report</i>			
<i>For the week ending April 10, 2008</i>						
<i>No.</i>	<i>Description used</i>	<i>Units scrapped</i>	<i>Units</i>	<i>% Scrap</i>	<i>Cost</i>	<i>Reasons</i>
Total for week						

Fig. 3.13 A Specimen of Scrap Report

Spoilage

Spoilage can be defined as the materials which in the process of manufacture are badly damaged or have developed some imperfection which cannot economically be corrected, and thus the goods ought to be sold as seconds. Spoiled units fail to reach the required standard of quality specifications. The cost of spoiled goods may be treated by either of the following methods:

1. The loss due to spoilage may be charged to a specific product or job on which the spoilage occurred, if it is clearly traceable to the work done on that order.
2. The normal spoilage loss may be charged to factory overhead and thus spread over the cost of all jobs/products.
3. The cost of abnormal spoilage (that is, due to causes not inherent in the manufacturing process) is transferred to the Costing Profit and Loss Account. Abnormal loss is unexpected and should have been avoided by management. It is considered controllable by management.

Spoilage Report

A spoilage report should be prepared detailing the spoiled units and cost of spoiled units and other relevant information (Fig. 3.14). To control spoilage, allowance for a normal spoilage should be determined in advance and actual spoilage should be compared with the standard (allowed) spoilage. A spoilage report

may enable managements to provide overall control over the spoilage costs. If all or many departments are involved, spoilage costs are then treated as a factory overhead. Sometimes, spoilage can be controlled by the individual machine operators. This requires daily or weekly spoilage reports which can reveal the spoiled work occurred, the reason for its occurrence and the cost of correcting the defects.

Spoilage Report

Units/Deptt No. _____ Date _____
 Production Order No. _____

Units produced	Units spoiled	Normal spoilage		Abnormal spoilage		Cost of abnormal spoilage (Rs.)	Reason for spoilage	Action taken
		Qty	%	Qty	%			

Fig. 3.14 A Spoilage Report

Defectives

Defective products are such semi-finished or finished products which in the process of manufacturing have developed some imperfection, but which, unlike spoiled materials, can by the expenditure of additional labour and possibly materials, be made into perfect finished articles. In the manufacturing process, imperfections may arise because of sub-standard materials, bad workmanship, careless planning, laxity in inspection, etc. If the unit can be reprocessed in one or more stages and made into a standard saleable product, it is often profitable to rework the defective unit. Defective work is to be distinguished from spoiled work. Defective work is work in which there is some imperfection which can be reworked or reconditioned by the application of additional materials, labour and/or processing and brought to the point of standard. However, the spoiled units cannot be reconditioned and the units must be sold either as scrap or as second or third-grade products.

The accounting treatment for defective work is similar to that relating to spoiled goods. The cost of defectives can be treated in the following manner:

- Normal defectives, that is, those defectives which are inherent in the manufacturing process and are identified as normal, can be treated in the following manner:
 - Charged to good products—The loss (the additional cost of defectives) is absorbed by good units produced.
 - Charged to general factory overheads—If defective units occur irregularly, the added cost of reworking and perfecting the defective goods is properly charged to factory overheads and apportioned as a part of that factory overhead.
 - Charged to the department overhead—If the department responsible for defective goods can be identified, the additional cost of perfection is charged to that department.
- If the defective units are clearly identifiable with a specific job or production order and the defects are peculiar to the job, the cost to complete the defective units can be charged to that job.

3. If defectives are abnormal and as due to reasons beyond the control of the business firm, the rework cost is charged to the Costing Profit and Loss Account.

Defectives Report

Inspectors scrutinise work-in-process at the completion of each stage of production in order to separate defective and spoiled products from those which equal the standard of perfection required of all finished production.

After inspection if it is found that it is necessary to recondition work found defective, a defective work report (see Fig. 3.15) is prepared and attached to the production order representing the defective work. The defective work report contains the number of the production order, a description of the nature of the defective work, the number of units involved, and additional cost of material, labour and applied factory overheads necessary to bring the products upto standard.

Waste (or Wastage)

The terms "spoilage" and "waste" are sometimes used synonymously. However, wastage generally refers to that portion of raw material which is lost in storing, handling and in manufacturing processes. It does not possess any recovery or realisable value. Waste for the purpose of accounting treatment is classified in two categories: Normal waste and Abnormal waste, (i) Normal waste is expected (unavoidable) and uncontrollable. It is treated as a part of the cost of the product, that is, the cost of normal waste unit is borne by the good remaining units. (ii) Abnormal waste is unexpected (avoidable) and controllable. It is valued like good output. Its cost is transferred to the Costing Profit and Loss Account. In case of normal waste, cost per unit of the finished output is relatively inflated, but in abnormal waste, cost per unit remains the same for abnormal units as well as good finished units.

Defective Work Report

Production order no. _____ No. _____
 No. of units _____ Date _____
 Department responsible for spoilage _____
 Nature of defects _____

Department (Job No.)	Description of additional work required	Rework costs			Total costs
		Materials cost	Labour cost	Applied factory overhead	

Fig. 3.15 Defective Work Report

THEORY QUESTIONS

1. Describe the meaning objectives, and basic principles of materials control system. *(B. Com. (Hons), Delhi)*
2. What are the important requirements of a materials control system. *(B. Com. (Hons), Delhi 2004)*
3. Distinguish between Bill of Material and stores requisition. *(B. Com. (Hons), Delhi 1997)*
4. Explain ABC system of inventory control. *(B. Com. (Hons), Delhi 1999)*
5. Explain Just-In-Time purchases. *(B. Com. (Hons), Delhi 2001)*
6. What do you understand by 'inventory control'. State its objects.
7. What are the objectives of inventory control? How is inventory control effected through ABC analysis of stores? *(ICWA, Inter)*
8. Define waste, scrap, defectives and spoilage with examples. Discuss the respective treatment in cost accounts and set out a procedure for their control. *(ICWA)*
9. "The Perpetual Inventory System is an integral part of materials control." Discuss this statement by bringing out briefly the salient features and advantages of the system. *(ICWA Inter)*
10. In ABC Company Ltd. waste, scrap, spoilage and defectives are very high. Suggest and explain various methods for accounting of wastage and scrap and also treatment of costs incurred on spoilage and defective work. *(ICWA Inter)*
11. Distinguish between spoilage and defectives in a manufacturing company. Discuss their treatment in cost accounts and suggest a procedure for their control. *(CA Inter)*
12. In a meeting of the department heads of a company, the purchase procedure and materials accounting were strongly criticised and blamed for high cost of materials. The Managing Director of the company authorises you to investigate and suggest improvements. Give your suggestions indicating the assumptions on which they are based.
13. Distinguish between Bin Card and Stores Ledger. *(B.Com. (Hons), Delhi, 2003, CA, PE, Exam II, Group II, May 2003, Nov. 2004)*
14. Enumerate the various factors to be considered in fixing the reorder level of raw material item. *(B.Com. (Hons) Delhi, 2004)*
15. Explain the concept of ABC analysis as a technique of material control. *(B.Com. (Hons), Delhi, 2004, 2006)*
16. What do you mean by inventory control? What are its techniques? Discuss briefly ABC system of inventory control. *(B.Com. Delhi, 2005)*
17. Describe the procedure for the efficient system of physical control of materials till it reaches the stores. *(B.Com. (Hons), Delhi, 2007)*
18. Distinguish between periodic and perpetual inventory system. Explain their comparative advantages and disadvantages. *(B.Com. (Hons), Delhi, 2007, B.Com. Delhi, 2004, 2006, 2007)*
19. What are the causes of discrepancies in stock records? How would you treat these discrepancies? *(B.Com. (Hons), Delhi, 2007)*
20. Under what circumstances is it essential to use continuous stock taking for control over materials? State its advantages. *(B.Com.(Hons), Delhi, 2002)*
21. Write short notes on the following:
 - (i) Re-order quantity
 - (ii) Re-order level
 - (iii) Maximum stock level
 - (iv) Minimum stock level*(CA, PE, Exam II, Group II, Nov. 2003)*
22. Discuss ABC analysis as a system of inventory control. *(CA, PE, Exam II, Group II, Nov. 2004)*
23. Discuss the accounting treatment of spoilage and defectives in cost accounting. *(CA, PE, Exam II, Group II, Nov. 2003)*
24. Write detailed explanatory notes on the following:
 - (i) JIT manufacturing
 - (ii) Kanban

25. Distinguish between JIT and traditional manufacturing.
 26. What is JIT? Discuss the advantages of JIT manufacturing system.

SELF-EVALUATION QUESTIONS

Select the correct answer for the following multiple-choice questions:

- Which one of the following items is not included in the annual carrying costs of inventory?
 - Cost of capital
 - Insurance on inventory
 - Annual warehouse depreciation
 - Taxes on inventory
 - Inventory breakage on stored inventory
- Economic order quantity (*EOQ*) model is used by a business to
 - Minimise the cost of placing orders
 - Minimise the unit purchase price of inventory
 - Minimise the number of orders placed during a year
 - Minimise the required amount of safety stock
 - Minimise the combined costs of placing orders and carrying inventory
- The calculation of inventory re-order point in units requires the
 - Purchase price per month
 - Annual demand for units
 - Daily demand for units
 - Storage cost per unit
 - Warehouse capacity
- Materials control system would be most useful to a
 - Manufacturer
 - Wholesaler
 - Hospital
 - Retailer
- Which of the following items would most likely be included in the calculation of economic order quality?
 - Price
 - Cost
 - Demand
 - Supply

Cost per purchase order	Rs.	40
Annual cost of carrying one unit in stock for one Year	Rs.	1.20
Annual consumption units		20,000

$$(a) \sqrt{\frac{2(20000 \times \text{Rs. } 40)}{\text{Rs. } 1.20}}$$

$$(c) \sqrt{\frac{2 \times 20,000 \times \text{Rs. } 1.20}{\text{Rs. } 20}}$$

$$(b) \sqrt{\frac{20000 \times \text{Rs. } 40}{\text{Rs. } 1.20}}$$

$$(d) \sqrt{\frac{20,000 \times \text{Rs. } 1.20}{\text{Rs. } 20}}$$

PROBLEMS

1. A manufacturer buys certain equipment from an outside supplier at Rs. 30 per unit. Total annual needs are 800 units. Further the following data are available.

Annual return on investment	10%
Rent, taxes, insurance per unit per year Re. 1	
Cost of placing an order	Rs. 100
Determine the economic order quantity.	

Ans: 200 units

2. In a factory component *A* is used as follows:

Normal usage 50 kg per week	Minimum usage 25 kg per week
Maximum usage 75 kg per week	Re-order quantity 300 kg
Re-order period 4 to 6 weeks	

Calculate the following for component *A*:

- (a) Re-order level
- (b) Maximum level
- (c) Minimum level
- (d) Average stock level

Ans: Re-order level 450 kg

Maximum level 650 kg

Minimum level 200 kg

Average stock level 425 kg

3. A company manufactures a product from a raw material, which is purchased at Rs. 60 per kg. The company incurs a handling cost of Rs. 360 plus freight of Rs. 390 per order. The incremental carrying cost of inventory of raw material is Re 0.50 per kg per month. In addition, the cost of working capital finance on the investment in inventory of raw materials is Rs. 9 per kg per annum. The annual production of the product is 1,00,000 units and 2.5 units are obtained from one kg of raw material.

Required:

- (i) Calculate the economic order quantity of raw materials.
- (ii) Advise, how frequently should orders for procurement be placed.
- (iii) If the company proposes to rationalise placement of orders on quarterly basis, what percentage of discount in the price of raw materials should be negotiated. *(C.A. Inter, Nov. 2001)*

4. In a company weekly minimum and maximum consumption of material *A* are 25 and 75 units respectively. The re-order quantity as fixed by the company is 300 units. The material is received within 4 to 6 weeks from issues of supply order. Calculate minimum level and maximum level of material *A*. *(CA Inter)*

Ans: Minimum level 200 units

Maximum level 650 units

5. About 50 items are required every day for a machine. A fixed cost of Rs. 50 per order is incurred for placing an order. The inventory carrying cost per item amount to Re. 0.02 per day. The lead period is 32 days. Compute:

- (i) Economic Order Quantity
- (ii) Re-order level

(CA Inter, Nov. 1996)

Ans: EOQ 500 units

Re-order level 1600 items

6. From the following information calculate Economic Order Quantity, and the number of orders to be placed in one quarter of the year:

(i) Quarterly consumption of materials	2,000 kg.
(ii) Cost of placing one order	Rs. 50
(iii) Cost Per unit	Rs. 40
(iv) Storage and carrying Cost	8% on average inventory

(B. Com. (Hons), Delhi 1997)

Ans: EOQ 500 kg

No. of order to be placed is 4.

7. ZEE is product manufactured out of three raw materials *M*, *N* and *Q*. Each unit of ZEE requires 10 kg, 8 kg, and 6 kg. of *M*, *N* and *Q* respectively. The re-order levels of *M* and *N* are 15,000 kgs and 10,000 kg. respectively while the minimum-level of *Q* is 2,500 kg. The weekly production of ZEE varies from 300 to 500 units, while the weekly average production is 400 units. You are required to compute

- the minimum stock level of *M*.
- the maximum stock level of *N*, and
- the re-order level of *Q*.

The following additional data are given:

	<i>M</i>	<i>N</i>	<i>Q</i>
Re-order Quantity (in kgs.)	20,000	15,000	20,000
Delivery (in weeks)			
Minimum	2	4	3
Average	3	5	4
Maximum	4	6	5

(ICWA Inter, Dec. 1995)

Ans: Minimum stock level of *M* 3,000 kg

Maximum stock level of *N*, 15,400 kg

Re-order level of *Q*, 15,000 kg

8. Materials *X* and *Y* are used as follows:

Minimum usage – 50 units each per week
 Maximum usage – 150 units each per week
 Normal usage – 100 units each per week

Ordering quantities	<i>X</i> = 600 units <i>Y</i> = 1000 units
Delivery period	<i>X</i> = 4 to 6 weeks <i>Y</i> = 2 to 4 weeks

Calculate for each material : (a) Minimum level; (b) Maximum level; and (c) Order level.

Ans.	<u>Material X</u>	<u>Material Y</u>
Minimum level	400 units	300 units
Maximum level	1300 units	1500 units
Order level	900 units	600 units

9. XYZ Company buys in lots of 500 boxes which is a 3 months supply. The cost per box is Rs 125 and the ordering cost is Rs 150. The inventory carrying cost is estimated at 20% of unit value. What is the total annual cost of the existing inventory policy? How much could be saved by employing the economic order quantity?

Ans: Total annual cost of existing inventory Rs. 6850

EOQ 155 units

Saving in annual cost if EOQ is adopted Rs. 2962.50

10. The following information in an inventory problem is available:

Annual demand	2400 units
Unit price (Rs.)	2.40
Ordering cost (Rs.)	4.00
Storage cost (Rs.)	2% per year
Interest rate	10% p.a.
Lead time	1/2 month

Calculate *EOQ*, Re-order level and total annual inventory cost. How much does the total inventory cost vary if the unit price is changed to Rs. 5? (ICWA Inter)

Ans: *EOQ* 258 units, Reorder level 100 units, Total annual inventory cost Rs. 5837.15.
Difference in total inventory cost Rs. 6272.55

11. A large local government authority places orders for various stationery items at quarterly intervals. In respect of an item of stock, data are as follows:

Annual usage 5000 boxes
Minimum order quantity 500 boxes
Cost per box Rs. 2

Usage of material is on a regular basis and on average, half of the amount purchased is held in inventory. The cost of storage is considered to be 25% of the inventory value. The average cost of placing an order is estimated at Rs. 1.25.

The chief executive of the authority has asked you to review the present situation and to consider possible way of effective cost savings. You are required to:

- Tabulate the cost of storage and ordering for each level of orders from four to twelve placed per year.
- Ascertain from the tabulation the number of orders which should be placed in year to minimise these costs.
- Calculate the percentage savings on the annual cost which could be made by using the economic order quantity system. (CIMA, UK)

12. Calculate the material turnover ratio for the year 2008 from the following information:

	<i>Material X</i>	<i>Material Y</i>
	(Rs.)	(Rs.)
Opening Stock	25,000	87,500
Closing Stock	15,000	62,500
Purchases	1,90,000	1,25,000

Determine the fast moving material

Ans: Turnover ratio
Material X-10
Material Y-2

Material X is the fast moving material.

13. The following information is available about a company for the year 2008.

	<i>Opening stock</i>	<i>Purchases</i>	<i>Closing stock</i>
Material A	700 kg	11,500 kg	200 kg
Material B	200 litres	11,000 litres	1200 litres
Material C	1000 kg	1800 kg	1200 kg

The inventory is value @ Rs. 1 per kg or litre.

Calculate the material turnover ratio for each of the above materials and express in number of days the average inventory held. What conclusions can be drawn?

<i>Ans:</i>	Turnover ratio	No. of days inventory held
	Material A	26.67
	Material B	14.29
	Material C	1.46

14 days approx.

26 days approx.

250 days

Material *A* has the highest inventory turnover ratio, while material *C* has the lower turnover ratio. Therefore, purchase of material *C* should be controlled.

14. After inviting tenders, two quotations are received as follows:

- (a) Rs. 1.20 per unit.
 (b) Rs. 1.10 per unit plus Rs. 3,000 fixed charges to be added irrespective of units ordered.
 Advise with your arguments on whom orders should be placed and what quantity is to be ordered.

The following additional information is available:

Present stock	35,000 units
Average monthly requirement	10,000 units
Maximum level	80,000 units
Minimum level	30,000 units

Ans: Order should be placed for 45,000 units with the second party.

15. A company's monthly requirement of an inventory item is 1,800 units. The cost of processing an order is Rs. 5 and the carrying cost per unit is 20 paise. The company supplier agrees to offer the following quantity discounts:

	Upto				Above
Lot size (in units)	400	401–600	601–800	801–1,000	1,000
Discount (in Rs.)	Nil	6	10	15	20

Lead time is 2 days and the company wishes to keep a safety equal to 50% of the usage in the lead time.

- (a) Find the economic ordering quantity (*EOQ*) without considering the offer of discount.
 (b) Calculate the re-order point taking 30 working days in a month.
 (c) Tabulate different types of cost as also effect of discount on different order sizes taking 1, 2, 3..., 7 orders a month and indicate the *EOQ*.

Ans: (a) 1039 units
 (b) 180 units
 (c) 450 units

16. JP Limited, manufacturers of a special product, follows the policy of *EOQ* (Economic Order Quantity) for one of its components. The component's details are as follows:

Purchase price for component	Rs. 200
Cost of an order	Rs. 100

Annual cost of carrying one unit in inventory: 10% of purchase price.

Total cost of inventory and ordering per annum: Rs. 4,000.

The company has been offered a discount of 2% on the price of the component, provided the lot size is 2,000 component at a time.

You are required to:

- (a) Compute the *EOQ*
 (b) Advise whether the quantity discount offer can be accepted.
 (Assume that the inventory carrying cost does not vary according to discount policy.)
 (c) Would your advise differ if the company is offered 5% discount on a single order? (CA, Inter)

Ans: (a) *EOQ* 200 units
 (b) Discount should be accepted because the total inventory cost will be lower by Rs. 3900 as compared to the total cost under *EOQ* policy.

MATERIALS COSTING

Learning Objectives

After reading this chapter, you should be able to:

1. explain meaning and treatment of different items in determining the cost of materials received;
2. discuss different methods of costing materials issued;
3. explain pricing of materials returned to vendor and storerooms, and
4. identify the factors to be considered in selecting a material pricing method.

COSTING MATERIALS RECEIVED

The invoice received from the supplier is the basic document providing a base figure for determining the cost of materials to be entered in the accounting books. This figure, however, is subject to adjustment and some other items may affect the cost of materials received. These items are:

Discounts

Discounts may be trade discount, cash discount and quantity discount.

Trade discount is allowed when a supplier sells the materials to a retailer who, in turn, resells the materials. Trade discount is deducted from the purchase price to determine the cost of materials purchased.

Cash discount is also known as purchase discount. Cash discount arises after the materials have been purchased and is offered by the supplier to his customer, provided payment is made at once or within an agreed stipulated time. There are two methods of treating such purchase or cash discounts.

1. The cash discount received while purchasing materials should be deducted from the invoice price of the materials. Thus, the materials cost price will be relatively reduced.
2. Alternatively, it may be treated as an item of financial nature (as additional income) and therefore be kept outside the purview of cost accounting. The full invoice price should be charged to the materials account crediting the suppliers with the net invoice price, and the discount earned account with the amount of cash discount received. It can be argued, however, that there is little justification for recording income on purchase; one can only earn income by selling or holding assets. Income is not produced by buying.

Quantity discount is a reduction in price given by a supplier to all large users of his product. This discount is deducted from the purchase price in arriving at the materials cost price. Also, this discount varies according to the size of the order for the purchase of materials.

Carriage Inwards on Raw Materials

It represents the expenditure incurred in bringing raw materials to the factory from outside and include sea, land and air freight, insurance, duties, dock charges, etc.

There is a difference of opinion as to treatment of carriage inwards. Accounting theory suggests that such charges are proper additions to the costs of materials purchased, since these costs are incurred in bringing the materials to the factory. But what is sound in theory is not always practicable, and deviations from theory are common. Where such costs are immaterial (small), or it is difficult to trace or even allocate such charges to specific items of materials (the cost to allocate such expenses to individual products outweighs the benefits to be obtained from such allocation), then these charges should be treated as an indirect manufacturing cost (factory overhead) which should be apportioned to product indirectly.

Material Handling Charges

The term "material handling costs" refers to the expense involved in receiving, storing, issuing and handling materials. Generally, such costs are part of the cost of materials and should be treated as a direct cost. But, in practice, such costs are most often treated as indirect costs. There is a practical difficulty in apportioning this cost to various materials items. The costs of operating the service departments involved in materials handling become a part of indirect manufacturing cost which is apportioned among the producing departments and then they are charged to product on labour hours, labour cost, machine hours, weight or any other appropriate basis.

Example 4.1

At what price per unit would Part No. A 32 be entered in the store's ledger, if the following invoice was received from a supplier?

<i>Invoice</i>	Rs.
200 units Part No. A 32 @ Rs. 5	1,000.00
Less 20% discount	200.00
	<hr style="width: 100%;"/>
Add excise duty @ 15%	120.00
	<hr style="width: 100%;"/>
Add packing charges (5 non-returnable boxes)	50.00
	<hr style="width: 100%;"/>
	970.00

Notes:

- (i) A 2% discount will be given for payment within 30 days.
- (ii) Documents substantiating payment of excise duty is enclosed for claiming MODVAT credit.

(CA, Inter)

Solution:**Computation of Purchase Price per Unit**

	Rs.
(a) Net cost of 200 units after trade discount	800
Add Packing Charges	50
Total Cost for 200 units	850

$$\text{Cost per unit} = \frac{\text{Rs. } 850}{200} = \text{Rs. } 4.25$$

Example 4.2

A manufacturer in Surat purchased three chemicals A, B and C from Mumbai. The invoice gave the following information:

	Rs.
Chemical A: 3,000 kg @ Rs. 4.20 per kg	12,600
Chemical B: 5,000 kg @ Rs. 3.80 per kg	19,000
Chemical C: 2,000 kg @ Rs. 4.75 per kg	9,500
Sales tax @ 5%	2,055
Railway freight	1,000
	<u>44,155</u>

A shortage of 200 kg in Chemical A, of 280 kg in Chemical B and of 100 kg in Ch

emical C was noticed due to breakages. At Surat, the manufacturer paid octroi duty @ 0.10 per kg. He also paid cartage Rs. 20 for Chemical A, Rs. 63.12 for Chemical B and Rs. 31.80 for Chemical C. Calculate the stock rate that you would suggest for issue price of chemicals assuming a provision of 5 per cent towards further deterioration.

(CA, Inter)

Solution:**Statement Showing Total Material Purchase Cost**

Particulars	Chemical A (Rs.)	Chemical B (Rs.)	Chemical C (Rs.)
Invoice price	12,600	19,000	9,500
Sales tax @ 5%	630	950	475
Railway freight (A : B : C : 3 : 5 : 2)	300	500	200
Octroi @ 0.10 per kg	300	500	200
Cartage	20	63.12	31.80
Total cost	13,850	21,013.12	10,406.80

Quantity Available for Issue

Particulars	Chemical A (kg)	Chemical B (kg)	Chemical C (kg)
Quality purchased	3,000	5,000	2,000
Loss due to breakage	(200)	(280)	(100)
	2,800	4,720	1,900
Provision for deterioration	(140)	(236)	(95)
Quantity available for issue	2,660	4,484	1,805

Pricing (Rate per kg) for Issue

Chemical A	Rs. 13,850 ÷ 2,660 or Rs. 5.20 (approx.)
Chemical B	Rs. 21,013.12 ÷ 4,484 or Rs. 4.68 (approx.)
Chemical C	Rs. 10,406.80 ÷ 1,805 or Rs. 5.76 (approx.)

Notes:

(i) Sales tax rate: $\frac{\text{Rs. } 2,025}{\text{Rs. } 41,000} \times 100$ or 5%

(ii) A better approach is to consider loss due to breakage as abnormal. Therefore, issue rates are calculated as follows:

	Chemical A	Chemical B	Chemical C
Quantity available for issue (kg)	2,660	4,484	1,805
Loss due to breakage (kg)	200	280	100
Total quantity to be priced (kg)	2,860	4,764	1,905
Total cost (Rs.)	13,850	21,013.12	10,406.80
Issue price (per kg)	4.84	4.41	5.46

Abnormal losses are debited directly to the costing profit and loss account as per details below:

Chemical A:	200 × Rs. 4.84	Rs. 968.00
Chemical B:	280 × Rs. 4.41	1,234.80
Chemical C:	100 × Rs. 5.46	546.00
		<u>Rs. 2,748.80</u>

Example 4.3

A foundry is melting pig iron for producing castings. Coke and limestone are used to melt the metal. 150 kg of coke and 50 kg of limestone are required to melt one ton of pig iron. The loss in melting is 5% and the rejection amounts to 10% of the casting made. Cost of pig iron is Rs. 895 per tonne. Cost of coke is Rs. 650 per tonne. Cost of limestone is Rs. 100 per tonne. Rejections fetch a return of 60 paise per kg. Find the cost of raw material per kg of saleable castings. (ICWA, Inter)

Solution:

<i>Cost of material</i>	<i>Amount (Rs.)</i>
Pig iron 1,000 kg	895.00
Coke 150 kg @ Re. 0.650	97.50
Limestone 50 kg @ Re. 0.100	5.00
	<u>997.50</u>
Normal rejections 95 kg @ Re. 0.60	(57.00)
Net total cost	<u>940.50</u>
Quantity of saleable cost iron: Input	1,000 kg
Loss in melting @ 5% of 1,000 kg	(50 kg)
Output	<u>950 kg</u>
Normal rejections @ 10% of 950 kg	(95 kg)
Saleable output	<u>855 kg</u>
Raw material cost per kg of saleable casting = $\frac{\text{Rs. } 940.50}{855 \text{ kg}} = \text{Rs. } 1.10$	

Notes:

1. Normal rejection: 10% of (input – melting loss), that is, 10% of (1000 – 50).
2. Cost of normal loss is borne by good units which are in good condition. This principle is used extensively in process costing method.

Example 4.4

From the following particulars workout the issue rate per 1000 each of first class and second class bricks.

- (a) Paid for supply at the kiln site for 30 lakh first class bricks @ Rs. 30 per 1,000.
- (b) Paid for supply at the kiln site for 60 lakh second class bricks @ Rs. 25 per 1,000.
- (c) Paid carriage charges for carrying all bricks from kiln to store yard @ Rs. 1.50 per 1,000.
- (d) Paid unloading charges Rs. 90 (lump sum).
- (e) Paid for stacking in the store yard Rs. 180 (lump sum).
- (f) Breakage in handling: 1% for first class bricks, 2% for second class bricks.

(ICWA, Inter)

Solution:

	<i>Total First class bricks</i>	<i>Cost (Rs.) Second class bricks</i>
Amount paid towards the cost of bricks:	90,000	1,50,000
Carriage charges @ Rs. 1.50 per 1,000	4,500	9,000
Unloading charges (apportioned in the Ratio of quantity, that is, 30 : 60)	30	60
Paid for stacking in the store yard (apportioned in the ratio of quantity, that is, 30 : 60)	60	120
	<u>94,590</u>	<u>1,59,180</u>

(Contd.)

(Contd.)

	Total First class bricks	Cost (Rs.) Second class bricks
Cost per 1,000 = $\frac{\text{Total cost}}{\text{(Total number in '000 - Normal loss)}}$		
First class brick	Rs. 94,590	Rs. 1,59,180
= $\frac{Rs. 94,590}{(3,000 - 1\% \text{ of } 3,000)}$		$\frac{Rs. 1,59,180}{(6,000 - 2\% \text{ of } 6,000)}$
= Rs. 31.8485		Rs. 27.0714
Thus, (a) Issue rate per 1,000 of first class bricks	Rs. 31.8485	
(b) Issue rate per 1,000 of second class bricks		Rs. 27.0714.

Notes:

In this case, cost-unit has been taken as 1,000 bricks.

Example 4.5

The particulars relating to 1,200 kg of a certain raw material purchased by a company during June were as follows:

- Lot prices quoted by supplier and accepted by the company for placing the purchase order:
 Lot up to 1,000 kg @ Rs. 22 per kg
 Between 1,000 – 1,500 kg @ Rs. 20 per kg
 Between 1,500 – 2,000 kg @ Rs. 18 per kg
 Prices are F.O.R. supplier's factory
- Trade discount 20%
- Additional charge for container @ Rs. 10 per drum of 25 kg
- Credit allowed on return of containers @ Rs. 8 per drum
- Sales tax @ 10% on raw material and 5% on drum
- Total freight paid by the purchaser Rs. 240
- Insurance at 2.5% (on net invoice value) paid by the purchaser
- Stores overhead applied at 5% on total purchase cost of material

The entire quantity was received and issued to production. The containers were returned in due course.

Draw up a suitable statement to show:

- Total cost of material purchased
- Unit cost of material issued to production

(ICWA, Inter)

Solution:

	Amount Rs.	Cost per unit Rs.
Raw material 1,200 kg @ Rs. 20	24,000.00	20.00
Trade discount @ 20%	(4,800.00)	(4.00)
	19,200.00	16.00
Charge for containers 48 @ Rs. 10	480.00	0.40

(Contd.)

(Contd.)

	Amount Rs.	Cost per unit Rs.
	19,680.00	16.40
Sales tax: Raw material @ 10% on Rs. 19,200	19,20.00	1.60
Containers @ 5% on Rs. 480	24.00	0.02
Net invoice value	21,624.00	18.02
Freight paid	240.00	0.20
Insurance @ 2.5% on Rs. 21,624	540.60	0.45
	22,404.00	18.67
Credit for containers 48 @ Rs. 8	(384.00)	(0.32)
	22,020.60	18.35
Stores overhead applied 5% on Rs. 22,020.60	1,101.03	0.92
	23,121.03	19.27
(i) Total cost of material purchased	Rs. 23,121.63	
(ii) Unit cost of material issued to production	Rs. 19.27	

Notes:

- Drums required = $\frac{\text{Total quantity}}{\text{Quantity per drum}} = \frac{1,200 \text{ kg}}{25 \text{ kg}} = 48 \text{ numbers}$
- If excise duty is to be charged separately, the amount is to be calculated on basic price, that is, on Rs. 24,000. The discount of 20% is to be calculated on basic price. Sales tax is to be calculated on (Basic price + Excise duty – Trade discount). Amount against other items is to be charged accordingly. Excise to be deducted if Modvat/Cenvat credit is available along with credit for container.
- Sales tax refund is not available on Rs. 8 being the amount refunded on return of containers.
- Usually, stores overheads are included in factory overheads and are not applied to materials as indicated in the given illustration.

Example 4.6

Modern Manufacturing Company purchased a material of 20 tonnes from a mining company. The following data is available for the lot of material purchased:

- Invoice price of material @ Rs. 2,000 per tonne
- Trade discount @ 20% on invoice price
- Excise duty @ 10% on invoice price
- Sales tax @ 10%
- Freight and insurance @ 2%
- Other charges for delivery @ Rs. 100 per tonne
- Cost of containers @ Rs. 20 per box of 1 quintal (100 kg)
- Cost of loading and unloading @ 1% of total cost

Compute total material purchase cost and cost per tonne to Modern Manufacturing Company.

(CA Inter)

Solution:

Modern Manufacturing Company
Statement Showing Total Material Purchase Cost of 20 Tonnes

<i>Particulars</i>	<i>Amount (Rs.)</i>
Invoice price of materials (Rs. 2,000 × 20 tonnes)	40,000
Trade discount (0.20 × Rs. 40,000)	(8,000)
	32,000
Excise duty (0.10 × Rs. 40,000)	4,000
	36,000
Sales tax (0.10 × Rs. 36,000)	3,600
	39,600
Freight and insurance (0.02 × Rs. 39,600)	792
	40,392
Other charges for delivery (Rs. 100 × 20 tonnes)	2,000
	42,392
Cost of containers (Rs. 20 × 10 quintal × 20 tonnes)	4,000
	46,392
Cost of loading and unloading (0.01 × Rs. 46392)	464
Total cost of material (20 tonnes)	46,856
Cost per tonne: Rs. 46,856 ÷ 20, or Rs. 2,342.80	

COSTING MATERIALS ISSUED

Where materials have been purchased for a specific product or specific job, the cost of materials received is wholly debited (charged) to that job. But most often, materials are purchased for several products or jobs. If all purchases were made at the same price, there would be no problem in costing materials issued and in inventory valuation. However, purchases made at different times usually carry different prices and the stores ledger card shows not one but several prices for the same kind of materials. Therefore, it becomes essential to consider the price at which it should be charged to production. Several methods are in use concerning the pricing of materials issued from the storeroom. They may be listed as follows:

- A. Cost Price Methods
 1. First-in, First-out (FIFO)
 2. Last-in, First-out (LIFO)
 3. Highest-in, First-out (HIFO)
 4. Base Stock Price
- B. Average Price Methods
 1. Simple average
 2. Weighted average
 3. Periodic simple average
 4. Periodic weighted average
 5. Moving simple average method
 6. Moving weighted average method
- C. Normal Price Methods
 1. Standard price
 2. Inflated price
 3. Replacement or market price

First-in, First-out (FIFO)

The FIFO method follows the principle that materials received first are issued first. After the first lot or batch of materials purchased is exhausted, the next lot is taken up for supply. It does not suggest, however, that the same lot will be issued from stores. Sometimes, all materials are tagged with their arrival date and issued in date order especially with stocks that deteriorate. The inventory is priced at the latest costs.

Advantages

A good system of inventory management requires that oldest units should be sold or used first and inventory should consist of the latest purchases. This is found in the FIFO method of costing. Under the FIFO method, management has little or no control over the selection of units in order to influence recorded profits. Valuation of inventory and cost of goods manufactured are consistent and realistic. Besides, the FIFO method is easy to understand and operate.

Disadvantages

The objectives of matching current cost with current revenues is not achieved under the FIFO method. If the prices of materials are rising rapidly, the current production cost may be understated. If the sales price is fixed, then sales revenue may not produce enough income to cover the purchase of raw materials. The valuation of inventory in terms of current cost depends on the frequency of price changes and the stock turnover. In case stocks turnover rapidly, the inventory valuations will reflect current prices. There are other limitations under the FIFO method. FIFO costing is improper if many lots are purchased during the period at different prices. This method overstates profit especially with high inflation. It does not consider the cost of replacing used materials, a situation created by high inflation.

The FIFO method is suitable where (i) the size and cost of raw materials units are large, (ii) materials are easily identified as belonging to a particular purchased lot, and (iii) not more than two or three different receipts of the materials are on hand at one time.

Example 4.7 explains the FIFO method of costing.

Example 4.7

The following is a summary of the receipts and issue of materials in a factory during January.

January

- 1 Opening balance 500 units @ Rs. 25 per unit
- 3 Issue 70 units
- 4 Issue 100 units
- 8 Issue 80 units
- 13 Received from supplier 200 units @ Rs. 24.50 per unit
- 14 Returned to store 15 units @ Rs. 24 per unit
- 16 Issue 180 units
- 20 Received from supplier 240 units @ Rs. 24.75 per unit
- 24 Issue 304 units
- 25 Received from supplier 320 units @ Rs. 24.50 per unit
- 26 Issue 112 units
- 27 Returned to store 12 units @ Rs. 24.50 per unit
- 28 Received from supplier 100 units @ Rs. 25 per unit

Work out on the basis of First-in, First-out. This revealed that on the 15th there was a shortage of five units and another on the 27th of eight units.

(CA Inter)

Solution:

Stores Ledger Account (FIFO)

Date	Receipts			Issue			Stock		
	Qty	Rate	Amt	Qty	Rate	Amt	Qty	Rate	Amt
Jan. 1	—	—	—	—	—	—	500	25.00	12,500
3	—	—	—	70	25	1,750	430	—	10,750
4	—	—	—	100	25	2,500	330	—	8,250
8	—	—	—	80	25	2,000	250	—	6,250
13	200	24.50	4,900	—	—	—	250	25.00	6,250
	Refund						200	24.50	4,900
14	15	24.00	360	—	—	—	250	25.00	6,250
							200	24.50	4,900
							15	24.00	360
15	—	—	Shortage	5	25	125	245	25.00	6,125
							200	24.50	4,900
							15	24.00	360
16	—	—	—	180	25	4,500	65	25.00	1,625
							200	24.50	4,900
							15	24.50	360
20	240	24.75	5,940	—	—	—	65	25.00	1,625
							200	24.50	4,900
							15	24.00	360
24	—	—	—	65	25.00	1,625			
				200	24.50	4,900			
				15	24.00	360			
				24	24.75	594			
25	320	24.50	7,680	—	—	—	216	24.75	5,346
							216	24.75	5,346
							320	24.50	7,680
26	—	—	—	112	24.75	2,772	104	24.75	2,574
							320	24.00	7,680
27	12	24.50	294	—	—	—	104	24.75	2,574
							320	24.00	7,680
							12	24.50	294
27	—	—	Shortage	8	24.75	198	96	24.75	12,376
							320	24.00	7,680
							12	24.50	294
28	100	2,500	2,500	—	—	—	96	24.75	2,376
							320	24.00	7,680
							12	24.50	294
							100	25.00	2,500

Closing stock 528 units = Rs. 12,750

Last-in, First-out (LIFO)

The LIFO method of costing and inventory valuation is based on the principle that materials entering production are the most recently purchased. The method assumes that the most recent cost, generally the replacement cost is the most significant in matching cost with revenue in the income determination. The cost of the last lot of materials received is used to price materials issued until the lot is exhausted, then the next lot pricing is used, and so on through successive lots. The inventory is priced at the oldest costs.

Advantages

1. It provides a better matching of current costs with current revenues.
2. It results in real income in times of rising prices, by maintaining net income at a lower level than other costing methods.
3. In industries subject to sharp materials price fluctuations, the method minimises unrealised inventory gains and losses and tends to stabilise reported operating profits. Income is reported only when it is available for distribution as dividends or for other purposes.
4. Probably the most important arguments in favour of LIFO is its role in tax saving. It is generally considered a cheap form of tax avoidance by business firms. By valuing inventory at beginning-of-period prices and calculating cost of sales at the current prices, the firm creates secret reserves which are not taxed. As long as prices and inventory levels do not decline, this benefit remains and in this case the tax saving is permanent. However, if the tax rates go up in the meantime, the so-called tax saving will be eliminated by higher tax rates.
5. LIFO produces an income statement which shows correct profit or losses and financial position. It correlates current cost and sales, and income statements show the result of operation, excluding profits or losses due to changing price levels.

Disadvantages

The following are the limitations of the LIFO method of costing:

1. Inventory valuations do not reflect the current prices and therefore are useless in the context of current conditions.
2. The argument that LIFO should be used for matching current costs with current revenue, is not sound. The most recent purchase costs are matched against the revenues of the current period. However, unless both purchases and sales occur regularly in even quantities, the revenues will not be matched with the current costs at the time of sale. When purchases are irregular and unrelated to the timing of sales, the matching is illogical and unsystematic, particularly if prices and costs are changing rapidly.
3. The profit of a firm can be manipulated with the LIFO method in operation. By timing purchases, a company can cause higher or lower costs to flow into the income statement, thus increasing or decreasing reported net income at will.
4. Another limitation which also results from LIFO's lowering of the earnings figure is the effect it will have on existing bonus and profit sharing plans. Employees and managers who are interested in the growth of these plans may have difficulty in understanding a drop in the benefits which were created wholly or partially by an accounting change.

During a period of rising costs, LIFO produces the desirable effect of reducing taxable income and tax liability; thereby conserving cash. On the other hand, it also affects the profit reported in the financial statements.

Example 4.8

Prepare a stores ledger account from the following transactions under the LIFO method.

Jan.	1	Received 1,000 units @	Rs. 1.00 per unit
	10	Received 260 units @	Rs. 1.05 per unit
	20	Issued 700 units	
Feb.	4	Received 400 units @	Rs. 1.15 per unit
	21	Received 300 units @	Rs. 1.25 per unit
March	16	Issued 620 units	
April	12	Issued 240 units	
May	10	Received 500 units @	Rs. 1.10 per unit
	25	Issued 380 units	

Solution:**Stores Ledger Account (FIFO)**

Date	Receipts			Issue			Stock		
	Qty	Rate	Amt.	Qty	Rate	Amt.	Qty	Rate	Amt.
1	2	3	4	5	6	7	8	9	10
January									
1	1,000	1.00	1,000	—	—	—	1,000	1.00	1,000
10	260	1.05	273	—	—	—	1,260		1,273
20	—	—	—	260	1.05	273	560		560
				440	1.00	440			
February									
4	400	1.15	460	—	—	—	960		1,020
21	300	1.25	375	—	—	—	1,260		1,395
March									
16	—	—	—	300	1.25	375	640		652
				320	1.15	368			
April									
12	—	—	—	80	1.15	92	400		400
				160	1.00	160			
May									
10	500	1.10	550	—	—	—	900		950
25	—	—	—	380	1.10	418	520		532

The Closing Stock consists of

120 units at Rs. 1.10 = 132

400 units at Re. 1.00 = 400

Rs 532

Highest-in, First-out (HIFO)

This method is based on the principle that materials received at the highest price in the stock are issued first. This will have the effect of pricing materials issued at the highest price and inventory valuation being made at the lowest possible prices. If the prices fluctuate widely, the highest cost will always be entering into the cost of goods sold. For instance, suppose on a particular date the stock ledger shows stock representing 500

units at the rate of Rs. 20, 700 units at the rate of Rs. 12, and 300 units at the rate of Rs. 25. If materials are issued, then out of the above three lots, first of all 300 units would be issued. After this lot is over, then the second lot of 500 units, which becomes the highest priced stock after despatches of 300 units, would be taken up for transmission to production departments. Like other methods, this method also requires detailed records on the stores ledger.

Base Stock Price

Under this method it is assumed that the minimum stock of a commodity which must always be carried is in the nature of a fixed asset and is never realised while the business continues. This minimum stock is carried at original cost. The stock in excess of this figure would be treated in accordance with one of the other methods, that is, FIFO or LIFO. The limitation of this method is that while measuring the return on capital employed in the business, the stock value may be under-valued and therefore the resulting business results will not be reliable.

Example 4.9

From the following information prepare a stores ledger account assuming 100 units as base stock following the FIFO method:

Rate		Rate per unit (Rs.)
January 1, 2007	Received 500 units	20
January 10	Received 300 units	24
January 15	Issued 700 units	—
January 20	Received 400 units	28
January 25	Issued 300 units	—
January 27	Received 500 units	22
January 31	Issued 200 units	—

Solution:

Stores Ledger Account
Base Stock Price with FIFO (minimum stock 100 units)

Date	Receipts			Issue			Stock		
	Qty	Rate	Amt	Qty	Rate	Amt	Qty	Rate	Amt
2007									
Jan. 1	500	20	10,000	—	—	—	500	20	10,000
Jan. 10	300	24	7,200				500	20	10,000
							300	24	7,200
Jan. 15	—	—	—	400	20	8,000	100	20	2,000
				300	24	7,200			
Jan. 20	400	28	11,200	—	—	—	400	28	11,200
Jan. 25	—	—	—	300	28	8,400	100	20	2,000
							100	28	2,800
Jan. 27, 2007	500	22	11,000				500	22	11,000
Jan. 31	—	—	—	100	28	2,800	100	20	2,000
				100	22	2,200	400	22	8,800

Simple Average

This method is based on the principle that materials issued should be priced on an average price and not on exact cost price. The simple average is an average of prices without having regard to the quantities involved. It should be used when prices do not fluctuate very much and the stock value is small. The average under this method is calculated by dividing the total of rates of materials in the storeroom by the number of rates of prices. This method is easy to operate.

Example 4.10

Prepare a stores ledger account by following the simple average method on the basis of information given in Example 4.9.

Solution:

Stores Ledger Account (Simple Average Price Method)

Date	Receipts			Issue			Stock		
	Qty	Rate	Amt	Qty	Rate	Amt	Qty	Rate	Amt
2007									
Jan. 1	500	20	10,000	—	—	—	500	20	10,000
Jan. 10	300	24	7,200	—	—	—	500	20	10,000
							300	24	7,200
Jan. 15	—	—	—	700	22	15,400	100		1,800
Jan. 20	400	28	11,200	—	—	—	500		13,000
Jan. 25	—	—	—	300	26	7,800	200		5,200
Jan. 27	500	22	11,000	—	—	—	700		16,200
Jan. 31	—	—	—	200	25	5,000	500		11,200

Average price for different issues has been calculated as follows:

Jan. 15 700 units = $20 + 24/2$ = Rs. 22 per unit.

Jan. 25 300 units = $24 + 28/2$ = Rs. 26 per unit

Jan. 31 200 units = $28 + 22/2$ = Rs. 25 per unit

Weighted Average

Under this method, issue of materials is priced at the average cost price of the materials in hand, a new average being computed whenever materials are received. In this method, total quantities and total costs are considered while computing the average price and not the total of rates divided by total number of rates as in simple average. The weighted average is calculated each time a purchase is made. The quantity bought is added to the stock in hand, and the revised balance is then divided into the new cash value of the stock. The effect of early price is thus eliminated. This method avoids fluctuations in price and reduces the number of calculations to be made, as each issue is charged at the same price until a fresh purchase necessitates the computation of a new average. It gives an acceptable figure for stock values.

Advantages

The following are the advantages of the weighted average method:

1. The method is logical and consistent as it absorbs cost while determining the average for pricing material issues.
2. The changes in the prices of materials do not much affect the materials issues and stock.

3. The method follows the concept of total stock and total valuation.
4. Both cost of materials issued and in stock tend to reflect actual costs.

Disadvantages

However, the weighted average method also has the following disadvantages:

1. Simplicity and convenience are lost when there is too much change in the prices of materials.
2. An average price is not based on actual price incurred, and therefore is not realistic. It follows only arithmetical convenience.

Example 4.11

Prepare a store ledger account on the basis of information given in Example 4.9 by following the weighted average method.

Solution:

Date	Receipts			Issue			Stock		
	Qty	Rate	Amt	Qty	Rate	Amt	Qty	Rate	Amt
2007									
Jan. 1	500	20	10,000	—	—	—	500	20	10,000
Jan. 10	300	24	7,200	—	—	—	800	21.50	17,200
Jan. 15	—	—	—	700	21.50	15,050	100		2,150
Jan. 20	400	28	11,200	—	—	—	500	26.70	13,350
Jan. 25	—	—	—	300	26.70	8,010	200		5,340
Jan. 27	500	22	11,000	—	—	—	700	23.34	16,340
Jan. 31	—	—	—	200	23.34	4,668	500		11,672

Periodic Simple Average

In cost accounting, where job costs may be prepared infrequently, say monthly, or bimonthly, it may be necessary to price materials issued by taking the average price ruling during that period. If it is calculated monthly, the average of the unit prices of all the receipts during the month is adopted as the rate for pricing issues during the month. Only a simple calculation has to be done at the end of the accounting period. The opening stock is not considered for computing periodic simple average because it has not been purchased during the current period and would have been included in the previous year's calculations. However, purchases made during the current year and closing stock are taken into account while computing this average. Basically, this method follows the principle of simple average price, but a period is set for which the average is calculated. Taking the above example, the total receipts and issue of the materials would be shown as follows:

Receipts			Issues		
Qty	Rate	Amt	Qty	Rate	Amt
1,700	94	39,400	1,200	23.50	28,200

$$\begin{aligned} \text{The periodic simple average} &= \frac{\text{Total prices of the materials}}{\text{Total No. of prices}} \\ &= \frac{94}{4} \text{ Rs. } 23.50 \end{aligned}$$

$$\begin{aligned}\text{Closing stock} &= \text{Units } 1700 - 1200 = 500 \\ &= \text{Rs. } 39,400 - 28,200 = \text{Rs. } 11,200.\end{aligned}$$

The above rate, that is, Rs. 23.50 per unit will be used for pricing the materials issued during the period.

Periodic Weighted Average

This method is quite similar to the weighted average price method with only one difference that in this method average price is not calculated at the time of every new receipt of materials but only periodically. Periodic weighted average is calculated by dividing the total value of the materials purchased during a given period, by the total quantity purchased during the same period. Opening stock-its value and quantity both—are not considered while computing this average. In the above example, the periodic weighted average will be computed as follows:

<i>Receipts</i>			<i>Issues</i>		
<i>Qty</i>	<i>Rate</i>	<i>Amt</i>	<i>Qty</i>	<i>Rate</i>	<i>Amt</i>
Total 1,700	23.18	39,400	1200	23.18	27,816

$$\text{Closing stock quantity} = 500$$

$$\text{Amount} = \text{Rs. } 11,584$$

Periodic weighted average

$$\begin{aligned}&= \frac{\text{Total cost of materials purchased}}{\text{Total quantity purchased}} \\ &= \frac{39,400}{1,700} \\ &= 23.18\end{aligned}$$

Moving Simple Average

Under this method periodic simple average prices are further averaged. In this way moving average is obtained by dividing periodic average prices (of different periods by the number of periods taken. The periods chosen cover the period in which the material is issued. The following example explains this method.

<i>Months</i>	<i>Periodic average price (Rs.)</i>	<i>Moving average price (Rs.)</i>
January	2.55	
February	2.65	
March	2.72	
April	2.95	
May	3.15	
June	3.25	2.88
July	3.40	3.02
August	3.50	3.16
September	3.68	3.32
October	3.80	3.46
November	3.90	3.59
December	4.15	3.74

In the above example, moving average has been obtained for a six month period.

The moving simple average method will give prices to be used for materials issues which are below the periodic average prices. This will be true when prices are showing an upward trend. In periods of falling prices, the resulting issue prices under the moving average method will be greater than the periodic average prices. This influences the value of closing stock which may be under-valued or over-valued.

Moving Weighted Average

This method finds the materials issues price by dividing the total of the periodic weighted average prices for a number of periods by the total number of such periods. This is similar to the moving simple average method.

Standard Price

This method charges materials issued into the factory at a predetermined budgeted, or estimated price reflecting a normal or an expected future price. A standard price is fixed for each class of materials in advance after making proper investigations. Receipts and issues of materials are recorded in quantities only on the materials ledgers, thereby simplifying the record-keeping. The difference between actual price and standard price is transferred to a purchase price variance which reveals to what extent actual costs are different from standard materials cost. Materials are charged into cost of goods sold at the standard price avoiding inconsistencies in different actual cost methods.

This method helps in knowing the purchase efficiency. If the total actual cost is less than the standard price, there will be favourable purchasing efficiency and vice-versa. This method is simple to operate and provides stability in costing system. However, standard price does not often reflect actual or expected cost, but only a generalised target. The stock value need not show actual cost incurrence and therefore does not necessarily conform to acceptable principles of stock valuation.

Inflated Price

This price includes carrying costs, cost of contingencies and also the losses arising out of evaporation, shrinkage, etc. This method aims to cover/recover the full cost of materials purchased.

Replacement Price or Market Price

Under this method materials issues are priced at replacement price on the date the issue is made. The replacement cost (market price) is the cost of securing the same type of material at the current moment in time. This method has the following advantages:

Advantages

1. The replacement cost approach matches current revenue against current cost and is therefore useful in measuring the operating results of a business firm correctly and accurately.
2. The use of replacement cost brings out clearly the difference between holding gains and operating gains and financial statement users will have a better understanding of the financial statement. If replacement cost is not used, the profit resulting due to holding of materials and inventory is taxed and therefore, impairs the capital of a business firm.
3. The replacement price if used, will disclose good or bad buying made by the purchase department of the firm.
4. The replacement cost approach helps in determining a selling price for the product which is competitive and realistic.
5. In case the prices of materials have decreased, the materials should be charged to the production at the current replacement price and the resulting loss should be taken into consideration in the accounts of the firm.

Disadvantages

However, this method has certain disadvantages. Firstly, the objectivity is lost in accepting the replacement cost as the basis of materials pricing. The "replacement" concept is a relative one and in the absence of market for the materials, no equitable replacement price is determinable. This increases the subjectivity in selection of a current replacement price. Secondly, this is not based on actual cost, that is, cost incurred, and therefore may add confusion and complications in cost accounting. Thirdly, this method is workable only when market prices are available and reflect current cost of replacing the materials.

Example 4.12

The following are the transactions in respect of purchase and issue of components forming part of an assembly of a product manufactured by a firm which requires to update its cost of production, very often for bidding tenders and finalising cost plus contracts.

Date	Quantity (in Nos)		Particulars
2007 January	5	1,000	purchased at Rs. 1.20 each
	11	2,000	issued
February	1	1,500	purchased Rs 1.30 each
	18	2,400	issued
	26	1,000	issued
March	8	1,000	purchased at Rs 1.40 each
	17	1,500	purchased at Rs 1.30 each
	28	2,000	issued

The stock on January 1, 2007 was 5,000 Nos valued at Rs. 1.10 each. State the method you would adopt in pricing the issue of components giving reasons. What value would be placed on stocks as on March 31 which happens to be the financial year-end and how would you treat the difference in value if any, on the stock account?
(ICWA Inter)

Solution:**Stores Ledger**

Date	Receipts			Issue			Stock		
	Qty	Rate	Amt	Qty	Rate	Amt	Qty	Rate	Amt
Jan. 1							5,000	1.10	5,500
5	1,000	1.20	1,200				6,000		6,700
11				1,000	1.20	1,200			
				1,000	1.10	1,100	4,000		4,400
Feb. 1	1,500	1.30	1,950				5,500		6,350
18				1,500	1.30	1,950			
				900	1.10	990	3,100		3,410
26				1,000	1.10	1,100	2,100		2,310
Mar. 8	1,000	1.40	1,400				3,100		3,710
17	1,500	1.30	1,950				4,600		5,660
28				1,500	1.30	1,950			
				500	1.40	700	2,600		3,010
31							2,600		3,010

Note:

The closing stock consists of 500 units @ Rs. 1.40 = Rs.	700
2,100 units @ Rs. 1.10 = Rs.	2,310
<u>2,600</u>	<u>Rs. 3,010</u>

The stores ledger shows that the value of closing stock based on actual cost is Rs. 3,010. The last purchase effected on March 17 @ Rs 1.30 per unit represents the current market price. On this basis, the value of stock as on March 31 works out to Rs. 3,380. This is higher than cost. Moreover in cost books stocks are shown at cost and not at market value. Hence, no adjustment is otherwise necessary.

Example 4.13

From the records of an oil distributing company, the following summarised information is available for the month of March 2005.

Sales of the month: Rs. 19,25,000

Opening Stock as on 1.3.2005: 1,25,000 litres @ Rs. 6.50 per litre

Purchases (including freight and insurance):

March 5 150,000 litres @ Rs. 7.10 per litre

March 27 100,000 litres @ Rs. 7.00 per litre

Closing stock as on 31.3.2005: 1,30,000 litres.

General administrative expenses for the month: Rs. 45,000

On the basis of the above information, work out the following using FIFO and LIFO methods of inventory valuation assuming that pricing of issues is being done at the end of the month after all receipts during the month:

- Value of closing stock as on 31.3.2005
- Cost of goods sold during March 2005
- Profit or loss for March 2005

(ICWA Inter)

Solution:**(A) FIFO Method of Pricing Issues****Stores Ledger**

Date	Particulars	Receipts			Issues			Balance		
		Qty litre	Rate Rs. per litre	Value Rs.	Qty litres	Rate Rs. per litre	Value Rs.	Qty litres	Rate Rs. per litre	Value Rs.
1.3.2005	Balance b/d							1,25,000	6.50	8,12,500
5.3.2005	Purchases	1,50,000	7.10	10,65,000				2,75,000		18,77,500
27.3.2005	Purchases	1,00,000	7.00	7,00,000				3,75,000		25,77,500
	Issues (3,75,000 - 1,30,000 = 2,45,000 units)				1,25,000	6.50	8,12,500	2,50,000		17,65,000
					1,20,000	7.10	8,52,000	1,30,000		9,13,000
		2,50,000		17,65,000	2,45,000		16,64,500			

(B) LIFO Method of Pricing Issues**Stores Ledger**

Date	Particulars	Receipts			Issues			Balance		
		Qty litres	Rate per litre Rs.	Value Rs.	Qty litres	Rate per litre Rs.	Value Rs.	Qty litres Rs.	Rate per litre	Value Rs.
1.3.2005	Balance b/d							1,25,000	6.50	8,12,500
5.3.2005	Purchases	1,50,000	7.10	10,65,000				2,75,000		18,77,500
27.3.2005	Purchases	1,00,000	7.00	7,00,000				3,75,000		25,77,500
	Issues				1,00,000	7.00	7,00,000			
					1,45,000	7.10	10,29,500	1,30,000		8,48,000
		2,50,000		17,65,000	2,45,000		17,29,500			

Closing stock, cost of goods sold, profit under FIFO

(a) Value of closing stock	Rs.	9,13,000
(b) Cost of goods sold (8,12,500 + 8,52,000)	Rs.	16,64,500
(c) Profit		
Sales	Rs.	19,25,000
Less: Cost of goods sold	Rs.	(16,64,500)
General administration expenses	Rs.	(45,000)
Profit	Rs.	<u>2,15,500</u>

Closing stock, cost of goods sold, profit under LIFO

(a) Value of closing stock	Rs.	848,000
(b) Cost of goods sold (7,00,000 + 10,29,500)	Rs.	17,29,500
(c) Profit:		
Sales	Rs.	19,25,000
Less: Cost of goods sold		17,29,500
General administration expenses		45,000
Profit	Rs.	<u>1,50,500</u>

Example 4.14

Show how the items given ahead relating to purchases and issue of raw material item will appear in the stores ledger card, using weighted average method for issue pricing:

	Units	Prices per units Rs.
Jan. 1	Opening balance	300
Jan. 5	Purchases	200
Jan. 11	Issue	150
Jan. 22	Purchases	200
Jan. 24	Issue	150
Jan. 28	Issue	200

(B.Com.(Hons), Delhi 2005,

Solution:**Store Ledger Account**

Date	Receipt			Issue			Balance	
	Qty	Rate	Amt.	Qty	Rate	Amount	Qty	Amt.
Jan 1	—	—	—	—	—	—	300	6,000
Jan 5	200	22	4,400	—	—	—	500	10,400
Jan 11	—	—	—	150	20.80	3,120	350	7,280
Jan 22	200	23	4,600	—	—	—	550	11,880
Jan 24	—	—	—	150	21.60	3,240	400	8,640
Jan 28	—	—	—	200	21.60	4,320	200	4,320

Issue Prices:

$$\text{Jan 11} = \frac{10,400}{500} \\ = \text{Rs. 20.80 per unit}$$

$$\text{Jan 24} = \frac{11,880}{550} = \text{Rs. 21.60 per unit}$$

$$\text{Jan 28} = \frac{8,640}{400} = \text{Rs. 21.60 per unit}$$

Example 4.15

The Stock Ledger Account for Material X in a manufacturing concern reveals the following data for the quarter ended Sept. 30, 2002.

	Receipts		Issues	
	Quantity Units	Price Rs.	Quantity Units	Price Rs.
July 1 Balance b/d	1,600	2.00	—	—
July 9	3,000	2.20	—	—
July 13	—	—	1,200	2,556
Aug. 5	—	—	900	1,917
Aug. 17	3,600	2.40	—	—
Aug. 24	—	—	1,800	4,122
Sept. 11	2,500	2.50	—	—
Sept. 27	—	—	2,100	4,971
Sept. 29	—	—	700	1,656

Physical verification on Sept. 30, 2002 revealed an actual stock of 3,800 units. You are required to:

- Indicate the method of pricing employed above.
- Complete the above account by making entries you would consider necessary including adjustments, if any, and giving explanations for such adjustments. (ICWA Inter.)

Solution:

- (a) The verification of the value of issues applied in the problem shows that Weighted Average Method of pricing has been followed. For example, the issue price of 1200 units of July 13 will be Rs. 2.13 $\left(\frac{\text{Rs. 2556}}{1200 \text{ units}} \right)$ which is the weighted average price of purchases made on July 9 and July 1 opening stock, calculated as follows:

$$\begin{aligned} \text{Weighted average price} &= \frac{(1600 \text{ units} \times \text{Rs. } 2) + (3000 \text{ units} \times \text{Rs. } 2.20)}{1600 \text{ units} + 3000 \text{ units}} \\ &= \frac{\text{Rs. } 9800}{4600 \text{ units}} \\ &= \text{Rs. } 2.13 \end{aligned}$$

- (b) The complete Stores Ledger account giving the transactions as stated in the problem together with the necessary adjustments is given below:

Stores Ledger Account (Weighted Average Method)

Date	Receipts			Issues			Balance			
	Qty Rs.	Rate Rs.	Amount Rs.	Qty Rs.	Rate Rs.	Amount Rs.	Qty	Rate	Amount	
July	1	1600	2.00	3,200			1,600	2.00	3,200	
	9	3,000	2.20	6,600			4,600	2.13	9,800	
	13				1200	2.13	2,556	3,400	2.13	7,244
Aug.	5				900	2.13	1,917	2,500	2.13	5,327
	17	3,600	2.40	8,640			6,100	2.29	13,967	
	24				1800	2.29	4,122	4,300	2.29	9,845
Sept.	11	2,500	2.50	6,250			6,800	2.37	16,095	
	27				2100	2.37	4,971	4,700	2.37	11,124
	29				700	2.37	1,656	4,000	2.37	9,468
	30				200*	2.37	473	3,800	2.37	8,995

Closing Stock: 3,800 units, value of closing stock = Rs. 8,995

* Shortage of 200 units has been charged at the weighted average price of the goods in stock.

Closing stock 3800 units \times Rs. 2.37 = Rs. = Rs. 9006. Since the figures of issue prices have been taken directly as given in the question, there is a minor difference in the value of closing stock.

Example 4.16

The following transactions in respect of material Y occurred during the six months ended 30th June, 2005.

Month	Purchase (units)	Price per unit (Rs.)	Issued (units)
January	200	25	Nil
February	300	24	250
March	425	26	300
April	475	23	550
May	500	25	800
June	600	20	400

Required:

The chief accountant argues that the value of closing stock remains the same, no matter which method of pricing of material issues is used. Do you agree? Why or why not? Detailed stores ledgers are not required.
(CA Inter)

Solution:

In the given problem the total number of units purchased from January to May 2005 is 1,900 and the same have also been issued during this period. Thus, there was no stock at the end of May, 2005 which could become opening stock for the next month. In June, 2005; only a single purchase and a single issue of material was made. The closing stock is of 200 units. In this situation, stock of 200 units at the end of June, 2005 will be valued at Rs. 20 per unit irrespective of the pricing method of material issues. Hence, one would agree with the argument of the Chief Accountant.

However, this will not be true with the value of closing stock at the end of each month. Moreover, the value of closing stock at the end of June, 2005 would have been different under different pricing methods if there were several purchases at different prices and several issues during the month.

Example 4.17

Oil India is a bulk distributor of oil. A periodic inventory of oil on hand is taken when the books are closed at the end of each month. The following summary of information is available for the month of December.

Sales Rs. 9,45,000
 General Administrative Cost Rs. 25,000
 Opening Stock 1,00,000 litres @ Rs. 3 per litre : Rs. 3,00,000
 Purchases (including freight in)
 Dec. 1 2,00,000 litres @ Rs. 2.85 per litre
 Dec. 30 1,00,000 litres @ Rs. 3.03 per litre
 Closing Stock Dec. 31, 1,30,000 litres

Compute the following by the first in-first out, weighted average and last in-first out method of inventory costing:

- Value of inventory on Dec. 31;
- Amount of cost of goods sold for Dec;
- Profit or loss for Dec.

(B.Com.(Hons), Delhi, 2007)

Solution:**FIFO Method**

(a) Closing Stock		
30,000 litre @ Rs. 2.85		85,500
1,00,000 litre @ Rs. 3.03		3,03,000
Value of closing stock		<u>Rs.3,88,500</u>
(b) Cost of Goods Sold		
Opening Stock 1,00,000 litre @ Rs. 3		3,00,000
<i>Add: Purchases</i>		
Dec. 1 2,00,000 litre @ 2.85	5,70,000	
Dec.30 1,00,000 litre @ 3.03	3,03,000	
		<u>8,73,000</u>
		<u>11,73,000</u>

		Rs.
Less: Closing Stock		3,88,500
Cost of Goods Sold		<u>7,84,500</u>
(c) Profit		
SALES	9,45,000	
Less: Cost of Goods Sold	<u>7,84,500</u>	
Gross Profit	1,60,500	
Less: General Administrative Cost	<u>25,000</u>	
PROFIT	<u>1,35,500</u>	

LIFO METHOD

		Rs.
(a) Closing Stock		
1,00,000 litre @ Rs. 3	3,00,000	
30,000 litre @ Rs. 2.85	<u>85,500</u>	
Value of Closing Stock	3,85,500	
(b) Cost of Goods Sold		
Opening Stock 1,00,000 litre @ Rs. 3		3,00,000
Add: Purchases		
Dec. 1 2,00,000 litre @ Rs. 2.85	5,70,000	
Dec.30 1,00,000 litre @ Rs. 3.03	<u>3,03,000</u>	
		<u>8,73,000</u>
		11,73,000
Less: Closing Stock		<u>3,85,500</u>
Cost of Goods Sold		<u>7,87,500</u>
(c) Profit		
SALES	9,45,000	
Less: Cost of Good Sold	<u>7,87,500</u>	
Gross Profit		1,57,500
Less: General Administrative Cost		<u>25,000</u>
Net Profit		<u>1,32,500</u>

Weighted Average Method

Unit	Rs.	Amount
1,00,000	3	3,00,000
2,00,000	2.85	5,70,000
<u>10,000</u>	<u>3.03</u>	<u>3,03,000</u>
4,00,000		11,73,000

$$\text{Weighted Avg Price} = \frac{11,73,000}{4,00,000} = 2.9325$$

Note:

We assume that all the units sold are sold on the last day of the month that is, on 31st Dec.

(a) Closing Stock

$$1,30,000 \times 2.9325 = 3,81,225$$

Cost of Goods Sold

	Rs.
Opening stock 1,00,000 Litre @ Rs. 3	3,00,000
Add: Purchases	
Dec. 1 2,00,000 Litre @ Rs. 2.85	5,70,000
Dec.30 1,00,000 Litre @ Rs. 3.03	3,03,000
	8,73,000
	11,73,000
Less: Closing Stock	381225
Cost of Goods Sold	7,91,775

(c) Profit

Sales	9,45,000
Less: Cost of Goods Sold	7,91,775
Gross Profit	1,53,225
Less: General Administrative Cost	25,000
Net Profit	1,28,225

Example 4.18

ABC Limited provides you the following information. Calculate the cost of goods sold and ending inventory, applying the LIFO method of pricing raw materials under the Perpetual and Periodical Inventory Control Systems.

Date	Particulars	Units	Per unit cost (Rs.)
January 1	Opening Stock	200	10
10	Purchases	400	12
12	Withdrawals	500	—
16	Purchases	300	11
19	Issues	200	—
30	Receipts	100	15

Also explain in brief the reasons for a difference in profit, if any.

(B. Com. (Hons. Delhi))

Solution:**Computation of Cost of Goods Sold and Ending Inventory**

Particulars	Under Perpetual Inventory Method	Under Periodic Inventory Method
	Units × Rate = Amount Rs.	Units × Rate = Amount Rs.
(i) Cost of Goods sold/withdrawn or issued:		
On 12th Jan.	400 × 12 = 4,800 100 × 10 = 1,000	100 × 15 = 1,500 300 × 11 = 3,300

(Contd.)

(Contd.)

		300 × 12 = 3,600
	5,800	700 Rs. 8,400
On 19th Jan.	200 × 11 = 2,200	
	Total Rs. 8,000	
(ii) Ending Inventory	100 × 10 = 1,000	100 × 12 = 1,200
	100 × 11 = 1,100	200 × 10 = 2,000
	100 × 15 = 1,500	
	300 Rs. 3,600	300 Rs. 3,200

Reasons for Difference in Profits. The cost of good sold/issued/withdrawn is more under Periodic Inventory System as compared to Perpetual Inventory System. Hence the profit under the former will be less as compared to the later. Alternatively, it can be so said that less the amount of ending inventory, less will be the profits.

Example 4.19

The following are the particulars regarding receipts and issues of certain material:

Opening stock	1,000 kg @ Rs. 9.00 per kg
Purchased	5,000 kg @ Rs. 8.50 per kg
Issued	600 kg
Issued	3,750 kg
Issued	650 kg
Purchased	2,500 kg @ Rs. 8 per kg

The credit balance of price variance account, before transfer to costing profit and loss account, was Rs. 500.

Calculate the standard rate at which the above issues should be made, and determine the value of closing stock.

Solution:

The standard price at which the materials were issued in the last period was Rs. 9. This gave a profit of Rs. 500.

Therefore, this time, materials should be valued at a lower standard price as compared to last period. The standard price for this period should therefore be:

$$\frac{\text{Rs. } 9,000 - \text{Rs. } 500}{1,000} = \frac{\text{Rs. } 8,500}{1,000} = \text{Rs. } 8.50 \text{ per kg}$$

Value of the Closing Stocks:

Opening stock	1,000	per kg @ Rs. 9	Rs. 9,000
Purchases	5,000	kg @ Rs. 8.50	42,500
Purchases	2,500	kg @ Rs. 8	20,000
	8,500		71,500
Less: Issues	5,000	@ Rs. 8.50	42,500
Balance	3,500 units		Rs. 29,000

The value of stock at standard price is Rs. 29,750 (3500×8.50). The stock therefore will be valued at Rs. 29,750 and Rs. 750 will be debited to the price variance account.

Example 4.20

The annual accounts of a trading company are to be made up to December 31 but it was not possible to carry out a stock-taking until January 5 at which date the stock was valued at cost at Rs. 68,567.

The following transactions took place between 1st and 5th January:

	Rs.
Goods received	4,600
Goods returned	200
Sales	10,500
Returns by customer	625
The rate of gross profit is 25% of cost.	

Prepare a statement to show the valuation of stock as at 31st December.

Solution:

Statement Showing the Valuation of Stock

	Rs.	Rs.
Stock as at 5th January		68,567
Add: Goods returned		200
Cost of goods sold:		
Sales	10,500	
Less: Gross profit $\left(\frac{25}{125} \times 10,500\right)$	2,100	
		8,400
Less: Goods received	4,600	77,167
Returns by customers	625	
		5,225
Valuation of Stock on 31st December		71,942

PRICING OF MATERIALS RETURNED TO VENDOR

A business firm may return materials to a supplier. In the financial books, purchase returns are valued at the price at which they are purchased. In cost accounting the following rules are generally applicable as to the valuation of such purchase returns.

1. In case the firm is following the FIFO method, the materials returned to the supplier would be valued at the price of the oldest goods in stock on the date on which the materials are returned.
2. The materials returned would be valued at the price of the latest units received and still in stock, if the firm is following the LIFO method.
3. Purchase returns would be valued at average price if the firm is following the average price method. The Quantity and value of materials returned are shown generally in the issues column. Alternatively, they may be shown in the receipts column in red ink.

Example

200 units were received from A @ Rs. 4 per unit

200 units were received from B @ Rs. 5 per unit

50 units received from A were returned to him.

In the first situation (when the firm is following FIFO method), assume 300 units were issued to production. In this, 50 units will be valued @ Rs. 5 per unit. However, if only 100 units were issued to production, then 50 units will be valued @ Rs. 4 per unit under FIFO method.

In the second situation (LIFO method), if 300 units have already been issued to production, 50 units will be valued @ Rs. 4 per unit. However, if only 100 units have been issued to production, then 50 units returned to A will be valued @ Rs. 5 per unit.

In the third situation, when the firm is following average price method, units returned will be valued in terms of average price (simple or weighted average as the case may be). Simple average or weighted average price will be calculated in the manner as explained earlier in this chapter.

PRICING OF MATERIALS RETURNED TO STOREROOM

When materials are returned from requisitioning departments to the storeroom for credit, the problem arises as to the proper method of handling such returns in stock ledger sheets. The following rules apply in this regard.

1. In case the firm is following the LIFO or FIFO method, the returned materials should be recorded at a price at which they have been originally issued and those units will be issued at the old price on the next requisition which is received. Alternatively, they may be treated as new purchases and retaining the original pricing, they can be given a position after the last purchase received.
2. If the firm is following the average price method, the returned materials should be recorded at the price originally issued, but a new average cost should be computed as if the goods returned were a new purchase.
3. Materials returned can be recorded at the current issue price also. That is, materials returned are priced at a price at which materials have been issued on the date of returns from the stores department. In this way, in this method, the issue price of materials (on the date of returns) is used to price materials returned to storeroom. In this method, there is no need to search original issue price of the materials returned and thus, this method saves time and clerical work.

The quantity and value of materials returned to the storeroom should be shown in the Issues column in red ink or alternatively they may be shown in the Receipts column.

SELECTION OF A MATERIALS PRICING METHOD

The various methods which are in use have advantages and disadvantages from the viewpoint of both convenience and accounting aspects. The factors which should be taken into consideration while deciding materials pricing methods are as follows:

1. Customs and practices within the industry or group of companies: This produces more comparable figures.
2. Frequency of price fluctuations and frequency of materials purchases.
3. Relative value of materials cost to total cost of products or jobs manufactured.
4. Range of price fluctuations.
5. Relative rate of stock turnover.

6. Quantities of materials to be purchased at any one time.
7. The effect of the different pricing methods on tax liability.
8. The accuracy with which materials issues can be computed.
9. Cost of clerical work involved in maintaining records.
10. The possibility of using different methods for various classes of items in the inventory.
11. The relationship of selling prices to the costs that are matched with those prices.

Costing materials present important, often complex and sometimes highly controversial questions concerning the valuation of materials used in production and the value of inventory remaining to be consumed at a future period. The different methods of materials pricing are difficult to compare adequately; this is a complex task. Some industries prefer the use of market prices for charging materials into production; market prices are the prices prevailing at the time the materials are used. These are the prices which would have to be paid if the materials were purchased at the time. This approach to materials costing has been gaining popularity over the recent years. This method reflects the current position, the current cost and the efficiency of purchasing done by a firm. In periods of rising prices, lowest material cost will flow into production under FIFO, highest materials cost under LIFO, and average costing will produce a material cost figure which is between FIFO and LIFO figures. In a period of falling prices the reverse situation will be found i.e., FIFO will show the highest cost of materials used, LIFO the lowest cost of materials used, and average costing will show a cost figure between FIFO and LIFO figures.

It is true that no one best method can be suggested, which is applicable to all situations; pricing methods may vary within the same company. It must be emphasised that whatever method is adopted, it must be consistently used from period to period. The most appropriate method is the one which produces accurate and meaningful cost figures for purposes of control and analysis and matching costs against revenue produced in order to determine the net operating income.

THEORY QUESTIONS

1. What are the methods of pricing materials issues? When do you advocate pricing the issues at cost price based on last-in, first-out? *(CA Inter)*
2. State the various methods of pricing the issue of materials or stores. State the method to be adopted for the issue of materials for an industry where their cost is fluctuating constantly. *(B. Com. Delhi)*
3. Explain the following two methods of pricing issue of materials and also the circumstance under which these methods are used.
 - (i) FIFO
 - (ii) LIFO *(ICWA Inter)*
4. Describe the following methods of valuing materials issued to production and discuss the advantage and disadvantage of each?
 - (i) First-in, First-out; (ii) Weighted Average; (iii) Replacement Price. *(CA Inter)*
5. Explain the FIFO methods of valuation of materials issues. Discuss the effects of rising prices and falling prices on these two methods of pricing of materials issues. *(CA Inter)*
6. What factors have to be considered for adopting a method for the pricing of materials? In the light of these and relevant factors, give a comparative description of LIFO and FIFO. *(B. Com. (Hons.) Delhi 2000, 2004)*
7. What are the conditions that favour the adoption of the Last-in, First-out system of materials pricing? Explain its working and indicate its advantages and limitations. *(CA Inter)*

8. Give the advantages and disadvantages of the actual cost basis of pricing of material issues.
(B. Com. (Hons.), Delhi)
9. Explain FIFO and LIFO methods of pricing of material issues. Which of these should be preferred in rising and falling prices and why?
(B. Com. (Hons.), Delhi, 2007)
10. Under conditions of rising prices, which of the following two methods of pricing material issues would you recommend and why?
(i) FIFO
(ii) LIFO
(B. Com. (Hons.), Delhi)
11. Briefly contrast the effects of using first-in, first-out with the last-in, first-out methods of pricing material issues from stores.
(B. Com. (Hons.), Delhi)
12. Write short notes on:
(i) LIFO vs FIFO
(ii) Bill of Materials
(iii) Perpetual Inventory System.

SELF-EVALUATION QUESTIONS

1. Which method of materials pricing best approximates specific identification of the actual flow of costs and units in most manufacturing situations?
(a) Average cost (b) FIFO
(c) LIFO (d) Base stock
2. Alpha company was using FIFO (and not LIFO) for materials pricing and its value of inventory was found lower. Assuming no opening inventory, what direction did the purchase prices move during the period?
(a) Up (b) Down
(c) Steady (d) Cannot be determined
3. A materials pricing method in which the oldest cost incurred rarely have an effect on the closing inventory valuation is
(a) FIFO (b) LIFO
(c) Simple average (d) Weighted average
4. Alpha company has been using LIFO method of materials pricing for 15 years. Its 2008 closing inventory was Rs. 15,000 but it would have been Rs. 26,000 if FIFO had been used. Thus, if FIFO had been used, this company's net income before taxes would have been
(a) Rs. 11,000 less over 15-year period
(b) Rs. 11,000 greater over 15-year period
(c) Rs. 11,000 greater in 2008
(d) Rs. 11,000 less in 2008

PROBLEMS

1. The following quotation is received from a supplier in respect of a material:
- Lot price 1,000 units — Rs. 5 each.
 „ 2,000 units — Rs. 4.75 each.
 „ 3,000 units — Rs. 4.00 each.
 Trade discount — 25%
 Freight charges per order—Rs. 100.
 Containers are charged at Re. 0.50 each.

One container is required for every 100 units and if containers are returned within two months, credit would be received at Re. 0.20 each.

Calculate the material cost for 3,000 units assuming that purchaser decided to purchase this lot.

Ans: Material cost Rs. 9109

2. The particulars relating to the import of sealing ring invoiced by AB and Co., during December 2002 are given below:

- (a) Sealing ring 1,000 pieces @ \$2.00 CIF Bombay Port.
- (b) Customs duty was paid @ 100% on invoice value (which was converted to Indian currency by adopting an exchange rate of Rs. 17.20 per \$).
- (c) Clearing charges Rs. 1,800 for the entire consignment.
- (d) Freight charges Rs. 1,400 for transporting the consignment from Mumbai port to factory premises.

It was found on inspection that 100 pieces of the above material were broken, and therefore, rejected. There is no scrap value for the rejected part. Also, no refund for the broken material would be admissible as per the terms of the contract. The management decided to treat 60 pieces as normal loss and the rest 40 pieces as abnormal loss. The entire quantity of 900 pieces was issued to production.

Calculate:

- (a) Total cost of material.
- (b) Unit cost of material issued to production.

Also state briefly how the value of 100 pieces rejected in inspection will be treated in costs. *(ICWA Inter)*

Ans: (a) Rs. 72,000

(b) Rs. 76.59 per piece

3. Calculate the raw material cost of 100 yards of hessian cloth made in a jute mill. The cloth contains 45% warp yarn and weighs 10 oz per yard. Wastage of yarn is 2% warp and 5% weft. Both the yarns are spun from jute fibre at Rs. 1.25 for warp and Rs. 1.08 for weft per quintal after treating the fibre with the mixture of water and oil at 50 paise per kg such that warp contains 5% oil and weft contains 7% oil. Loss of fibre up to spinning is 5% warp and 10% weft. All percentage except the yarn content in cloth are input based. *(ICWA, Inter)*

Ans: Rs. 37.50

4. From the following details of stores receipts and issues of material "EXA" in a manufacturing unit, prepare the Stock Ledger using "Weighted Average" method of valuing the issues:

Nov. 1	Opening stock 2,000 units @ Rs. 5 each.
Nov. 3	Issued 1,500 units to Production.
Nov. 4	Received 4,500 units @ Rs. 6.00 each.
Nov. 8	Issued 1,600 units to Production.
Nov. 9	Returned to stores 100 units by Production Department (from the issues of November, 3).
Nov. 16	Received 2,400 units @ Rs. 6.50 each.
Nov. 19	Returned to the supplier 200 units out of the quantity received on November, 4.
Nov. 20	Received 1,000 units @ Rs. 7.00 each.
Nov. 24	Issued to Production 2,100 units.
Nov. 27	Received 1,200 units @ Rs. 7.50 each.
Nov. 29	Issued to Production 2,800 units.
	(use rates upto two decimal places).

(ICWA Inter)

Ans: Cost of issued materials Rs. 18,256

Closing stock Rs. 19,558

5. You are presented with the following information by Sphix Engineering Co. relating to the first week of September, 2008.

Materials—The transactions in connection with the materials are as follows:

Days	Receipts		Issues Units
	Units	Rate per unit (Rs)	
1st	40	15.00	
2nd	20	16.50	
3rd			30
4th	50	14.30	
5th			20
6th			40

Calculate the cost of materials issued under FIFO method and Weighted Average Method of issue of materials.

Ans:

	Cost of materials issued		Stock	
	Units	Amt Rs.	Units Rs.	Amt.
FIFO	90	1359	20	286
Weighted Average	90	1350	20	295

6. The stores ledger of a manufacturing Company reveals the following entries of a particular material.

Date	Receipts			Issues		
	Quantity in units	Rate Rs.	Amount Rs.	Quantity in units	Rate Rs.	Amount Rs.
2002						
January						
2	4,000	1.80	7,200			
5	2,000	1.75	3,500			
18				10,000		19,500
February						
5				5,000		9750
14	3,000	1.85	5,550			
18	3,000	1.90	5,700			
20				10,000		19,200

Opening stock as on 1.1.2002 was 20,000 units valued at Rs. 40,000, Closing stock as per physical verification on 28.2.2002 was 6,950 units.

Work out the method of pricing the issue which you consider to have been adopted for the issue of the material and show the working of the issue rates (correct to 2 places of decimal). Complete the account of the material and work out the value of the closing stock as on 28.2.2002 on the basis of valuation adopted and also under any other method of valuation, you are familiar with. (ICWA Inter)

Ans: Closing Stock
 Weighted Average 6950 units Rs. 13404
 FIFO 6950 units Rs. 12912.50
 In the given question weighted average rate method has been used in preparing the Stores Ledger of the Company.

7. Show the stores ledger entries as they would appear when using

(a) the weighted average method

(b) the LIFO method of pricing issues, in connection with the following transactions:

April	Unit	Value
1 Balance in hand	300	600
2 Purchased	200	440
4 Issued	150	
6 Purchased	200	460
11 Issued	150	
19 Issued	200	
20 Purchased	200	480
27 Issued	250	

In a period of rising prices such as above what are the effects of each method?

Ans: (a) 150 units Rs. 342; (b) 150 units Rs. 300. (ICWA, Inter)

8. On January 1, Mr. G started a small business buying and selling a special yarn. He invested his savings of Rs. 4,00,000 in the business and during the next six months, the following transactions occurred:

Date of receipt	Yarn Purchase		Yarn Sales		
	Quantity boxes	Total cost (Rs.)	Date of despatch	Quantity boxes	Total value (Rs.)
January 13	200	7200	February 10	500	25,000
February 8	400	15200	April 20	600	27,000
March 11	600	24000	June 25	400	15,200
April 12	400	14000			
June 15	500	14000			

The yarn is stored in premises Mr G. has rented and the closing stock of yarn counted on 30th June was 500 boxes.

Other expenses incurred and paid in cash during the six months period amounted to Rs. 2300.

Required:

(a) Calculate the value of the material issues during the six month period and the value of closing stock at the end of June, using the following methods of pricing:

(i) FIFO

(ii) LIFO, and

(iii) Weighted average

(b) Calculate and discuss the effect each of the three methods of material pricing will have on the reported profit of the business, and examine the performance of the business during the first six month period.

(ICMA, U.K., Adapted)

<i>Ans:</i>	<i>Closing stock</i>	<i>Cost of sales</i>	<i>Profit</i>
FIFO	Rs. 14,000	Rs. 19,600	4,500
LIFO	Rs. 19,600	Rs. 54,800	10,100
Weighted Average	Rs. 16,486	Rs. 57,914	6,986

9. A consignment consisted of two chemicals A and B. The invoices gave the following data:

Chemical A—4,000 lb @ Rs. 2.50 per lb...	Rs. 10,000
Chemical B—3,200 lb @ Rs. 3.25 per lb...	Rs. 10,400
Sales tax	Rs. 816
Railway freight	Rs. 384
Total cost	Rs. 21,600

A shortage of 200 lb in *A* and 128 lb in *B* was noticed due to breakage. What stock rate would you adopt for pricing issues assuming a provision of 5% towards further deterioration?

Ans: Material *A* Rs. 2.94
Material *B* Rs. 3.76

10. You are the Chief Accountant of a sugar factory, whose cost of production per tonne of sugar is given below:

	30-6-2006 (Rs.)	30-6-2007 (Rs.)
Sugarcane cost	1,700	1,900
Sugarcane transport and supervision	50	55
Other process chemicals	45	50
Fuel	15	16
Salaries, wages and bonus	60	75
Repairs, renewals and maintenance	125	135
Packing materials and expenses	75	85
Interest	250	150
Selling overheads	20	20
Administration overheads	85	95
Depreciation	300	300
Total cost	<u>2,725</u>	<u>2,881</u>
Free market sale price	2,800	4,800
Controlled market sale price	2,600	2,600
Export price	1,650	5,400

Salaries, wage and bonus include administration salaries Rs. 20.

You have been valuing the closing stock of sugar consistently at cost or market price whichever is lower. For the purpose of arriving at cost you have been taking the total cost as given above.

The auditor objects to the method of arriving at cost adopted in view of Accounting Standard No. 2 on valuation of inventory and he wants to exclude the depreciation, interest, administration and selling overheads.

Keeping the stipulations of the Accounting Standard-2 in view, give your opinion on:

- What shall be the cost for the purpose of valuation of stock in both the above years?
- In view of the accumulation of heavy stock, the directors want to be consistent with the method of valuation of stocks as in the past in order to present a reasonable financial position. Will you be able to convince the auditors that the method of arriving at total cost is the correct method and, if yes, how?
- If the author's opinion is adopted, what shall be the nature of disclosure in the published accounts, if any?
- What shall be the basis for valuing stock in each of the above years?

Note:

Local sales price include excise duty of Rs. 500 per tonne.

(ICWA, Final)

Ans. (a) Total cost year 2006, Rs. 2,350

Year 2007, Rs. 2,596

- Depreciation of factory assets is a part of factory overhead and must be included in product costs. Auditor's opinion to exclude it is not reasonable.
- Auditor's opinion amounts to change in accounting policy and as per AS2, it should be disclosed.
- Lower of cost and minimum of realisable values.
year 2006 Rs. 1,650
year 2007 Rs. 2,100

11. The Directors of Quality Machineries Ltd. requests you to ascertain the amount at which the inventory should be included in the financial statement for the year 2006-07. The value of inventory as shown in the books is Rs. 12,50,000.

To determine the net realisable value of the inventory (on test check basis), you had selected several items whose books value was Rs. 3,50,000.

You ascertain that except for items (a) to (c) below, the cost was in excess of the realisable value by Rs. 29,532.

The following items require special treatment:

- (a) One machine (cost Rs. 1,30,000) can now fetch Rs. 1,15,000. It was priced at Rs. 70,000 and was written down to the same figure at the end of 2006-07.
- (b) A pump (cost Rs. 50,000) was expected to realize Rs. 35,000. A special commission of 15% would have to be paid to the broker.
- (c) 6 units of product no. 15,710 were in stock and each valued at Rs. 5,520; the selling price was Rs. 4,500 per unit; selling expenses are 10% of the selling price.

Taking into consideration only the above mentioned items requiring special treatment, compute the value of their inventory as at 31st March, 2007, you would consider reasonable. (C.A. Final)

Ans: Value of all the items of inventory Rs. 11,01,398.

LABOUR COSTS: ACCOUNTING AND CONTROL

Learning Objectives:

After reading this chapter, you should be able to:

1. explain direct and indirect labours, their nature;
2. discuss the importance of various organisational departments in exercising control over labour costs;
3. explain straight time and piece work methods of wage system, different incentive wage plans;
4. describe method study, time and motion study, work measurement, merit rating and various job evaluation methods, difference between job evaluation and merit rating;
5. discuss labour turnover, its causes and costs; and
6. explain treatment of labour-cost related items such as overtime premium, idle time, fringe benefits etc.

INTRODUCTION

Proper control and accounting for labour costs is one of the most important objectives of all business firms. Cost accounting for labour has three primary objectives:

1. Determining labour costs in the cost of product or service.
2. Reporting labour costs for planning and control.
3. Reporting labour costs for decision-making.

For a manufacturing business firm engaged in producing a specific product, labour costs are accumulated and charged to the product as they are produced. Similarly, in a service (not-for-profit) organisation, total cost as well as the cost of different functions (services) are to be determined. This helps the organisation to know what it costs them to provide a service or perform some activities.

The second objective is to provide management with labour cost information for effective planning of the labour force in the organisation and for adequate control of labour costs. The control process of labour cost involves a comparison of actual labour costs with standard labour cost. The differences between the two are then analysed and possible reasons are determined so that management can take suitable action to control the labour cost expenditure in future periods.

Labour cost information is used for decision-making purposes also. Many managerial decisions, such as pricing decisions, expansion of business, dropping a product line, replacement of plant and equipment, entering into a new market, etc. require information about current actual labour costs and emerging trends therein.

DIRECT LABOUR AND INDIRECT LABOUR

Direct Labour

Direct labour consists of the wages paid to labour which convert raw materials into some form of finished output. Direct Labour cost comprises the wages which can be identified with, and allocated to cost units. Examples of some direct labour functions in a manufacturing enterprise would be assembly line workers, moulders, operators, samplers and finishers.

Indirect Labour

Indirect labour is the labour which is not engaged in converting raw materials into finished output. The indirect labour cost is the cost which "cannot be allocated" but which can be apportioned to, or absorbed by, cost centres or cost units." Indirect labour includes, among others, formen, inspectors, watchmen, supervisors, factory clerks, store-keepers and time-keepers. In fact, after charging to departments and to products all labour costs which can, as a practical matter, be charged directly, the indirect labour costs remain.

ORGANISATION FOR LABOUR CONTROL

The significant portion of labour costs in the total cost of production points out its importance and need for effective control over labour and labour-related costs. The following departments/functions contribute to the efficient utilisation of labour and adequate control over labour costs.

1. Personnel Department
2. Engineering Department
3. Time-keeping Department
4. Payroll Department
5. Cost Accounting Department

Personnel Department

The main function of the personnel department is to provide an efficient labour force. The personnel manager/director with the help of department heads is responsible for the execution of the policies formulated by board of directors regarding employment, discharge, classification of employees, wages and wage systems. Hiring of employees may be for replacement or for expansion. Replacement hiring starts when a department head or a foreman sends an employee requisition (see Fig. 5.1) to the personnel department.

The personnel department prepares an Employee's Record Card on engaging a new worker. This will show full personal details of the employee, particulars of previous employment, medical category and wage rate. Normally, spaces are also provided for subsequent recording of transfers and promotions, wage rate revisions, details of attendance, merit and conduct reports, sickness and accidents and the date and reason for leaving (see Fig. 5.2).

Engineering Department

The engineering department maintains control over working conditions and production methods for each job and department or process by performing the following functions:

1. Preparation of plans and specifications for each job scheduled for production.
2. Supervision of production activities with production departments.

* The term "allocation" means the allotment of whole items of cost centres or cost units.

Employee Requisition

Requisition No. _____
 Date _____
 Department _____

Report to _____
 (Supervisor or Foreman's Name)
 on _____

Number of employees requested	Job Specification Description No.
-------------------------------	-----------------------------------

Requisitioned by _____ Approved by _____

Fig. 5.1 Employee Requisition

<i>Front Particulars</i>	<i>Employment Record</i>			
Home address	Date	Department	Grade	Employment
Date employed				
Date of birth				
Married/Single				
Height				
Weight				
General physique (Category)				

<i>Wage Rate Record</i>						
Previous Employment	Date	Rate	Particulars	Date	Rate	Particulars

References:
 Notes:

Fig. 5.2 a Employee's Record Card (Front Side)

Back

Time-keeping and Merit				Training, Progress and Conduct		
Year	Days lost	Overtime	Lost time	Merit and	Date	Particulars
	Sickness	Others	hours	hours	notes	

Date left:
 Reason for leaving:
 General remarks:

Fig. 5.2 b Employee's Record Card (Back Side)

3. Inspection of parts and jobs at successive stages of production and at the completion of production.
4. Initiation and supervision of research and experiment work.
5. Safety and efficient working conditions.

Time-keeping Department

The first step in accounting for labour cost is to prepare an accurate record of the time spent by each employee. Time-keeping in labour costing and control is important because of the following reasons:

1. It accumulates the total number of hours worked by each employee so that his earnings can be calculated.
2. Absence of a time-keeping arrangement will create frustration among those employees who are punctual or bound by the attendance rules.
3. Certain benefits like pension and gratuity, leave with pay, provident fund, salary, promotion are linked with continuity of service of employees. Attendance records, in this regard, can be helpful and useful to employees.
4. Overhead costs being indirect costs are apportioned to different products on some equitable basis. Time-keeping is necessary if apportionment is to be done on the basis of labour hours.
5. Time-keeping records and attendance details may be used by the firm for analysis proposed and by researchers, government authorities, etc.

Clock Card

The most common form of attendance record is the clock card on which the employee punches the time at which he comes in and leaves the factory. Each week, a new card is prepared for each employee on the payroll. At the end of the week, the cards are collected and transferred to the payroll department for calculation of gross earnings.

Daily Time Report

No. _____
 Name _____
 Nature of Work _____

Job No.	Time on		Time off		Time worked	
	Hours	Minutes	Hours	Minutes	Hours	Minutes
561	8	00	12	00	4	00
357	12	30	1	30	1	00
816	1	30	2	15	0	45
548	2	15	3	00	0	45
751	3	00	4	30	1	30
Foreman						

Fig. 5.3 Daily Time Report

Clock cards provide a record of the total hours, employees were available on jobs. However, this card does not reveal as to how employees spend their time which is an important question to be solved before entries can be made in the cost records. This information is supplied by time tickets or daily labour summaries (see Fig. 5.3) on which time-keepers record the daily activities of direct labour; time spent on specific orders, time spent on indirect labour operations such as machine maintenance, or idle time waiting for reassignment or machine set-up.

Disc Method

A second method of recording time is by using a metal disc which contains an identification number for each employee. A board containing hooks to which employees' discs are attached is kept near the entrance to the plant. On arrival, the employee removes his disc and places it in a box, or alternatively hooks it on a second board against his number. The box is removed at starting time, and the time-keeper becomes aware of late arrivals by requiring the workers concerned to report to him before starting. The time-keeper will record in an Attendance Register any late arrivals and workers leaving early. He will also detail the absentees each day.

Attendance Records

The simplest form of attendance records is a manual register which each employee signs into on arrival and departure, noting his times in and out. This type of time-keeping record is subject to limitations and many abuses by employees. In a business firm where a large number of workers are employed, and if the worker records his own time, it provides very little check upon late arrivals. The disadvantages of manual registers and time registers are the hold-ups that occur when each worker has to sign his name in turn, and the amount of clerical work involved in the posting of entries to individual attendance records.

Time-booking

Time-booking like time-keeping is equally important. Time-booking means recording the time spent by a worker on each job, process or operation. Time-booking fulfils the following purposes:

1. To determine amount of labour cost which can be obtained through time-booking is required.
2. To determine the quantity and value of work done.
3. To determine earnings like wages, bonus which depend on the time taken by a worker in performing job or jobs in a factory.

Recording work time can be done by any one of the following methods:

Job Ticket

Job tickets are given to all workers where time for commencing the job is recorded as well as the time when the job has been completed. After completing one job, the worker is given another job ticket for the next job to be completed by him.

Labour Cost Card

This card is meant for a job which involves many operations or stages of completion. Instead of giving one card to each worker, only one card is passed on to all workers and time taken on the job is recorded by each one of them. This card disclose the aggregate labour cost of the job or the product.

Weekly Time Sheets

A sheet is given to each worker to record time on a weekly basis. However, weekly time sheets should be filled up without much delay on each day failing which some inaccuracies are bound to occur on the time sheets.

Daily Time Sheets

Each worker records the time spent by him on the work during the day for which a sheet is provided to each worker. Since time is recorded on a daily basis, accuracy is built up on the time sheets. However, daily time sheets are generally not used. This could be used for maintenance and repairmen who have to do different jobs in different departments.

Time and Job Card

This card records the attendance time of workers and work time of a worker on a single sheet.

Payroll Department

Preparation of the payroll from clock cards, job or time tickets, or time sheets is done by the payroll department. The payroll department (tabulation) is an intermediate function between the time-keeping (accumulation) and the cost accounting (analysis) department. The following are the functions of the payroll department:

1. To compute employee wages.
2. To pay employees and for prompt and accurate reporting of wages and salaries to employees.
3. To prepare departmental payroll summaries.
4. To maintain individual employee payroll records.
5. To calculate payroll taxes, deductions and other related payroll liabilities.
6. Compilation of labour statistics for management.

The responsibilities of the payroll department in controlling and accounting for labour costs are as follows:

1. To maintain a record of the job classification, department and wage rate for each employee.
2. To verify and to summarise the time of each worker as shown on the daily time cards.
3. To compute the wages earned by each worker.
4. To prepare the payroll for each department showing the total amount earned for the period by each employee.
5. To compute the payroll deductions under the Acts.
6. To compute the payroll deductions authorised by the employee for union dues, charitable donation, saving bonds, and health and accidental insurance.
7. To maintain a permanent payroll record for each employee.
8. To distribute salary and wage payments.

Cost Accounting Department

The cost accounting department is responsible for the accumulation and classification of all cost data of which labour costs are one of the most important elements. On the basis of the labour summary or the time or job cards, the cost department records direct labour cost on the appropriate cost sheets or production reports and indirect costs on the departmental expense sheets.

WAGE SYSTEMS

An important aspect of labour cost control is a wage system designed primarily for exercising management control over labour. The following objectives should be considered in the selection of a wage system:

1. Acceptance by employees to avert slowdowns and work stoppages.
2. Provision for flexibility.
3. Provision for economy in administration.
4. Supplying of labour statistics for use in industrial relations and for trade associations, government agencies, and competitors.
5. Stabilisation of labour turnover.
6. Minimising of absenteeism.
7. Provision for incentive plans.

Basically there are two wage systems to pay for labour: (i) straight time which is by hour, day, or week, and (ii) piece work, which is by the unit of product.

Straight Time

Under the time basis, the worker is paid at an hourly, daily or weekly rate and his remuneration depends upon the time for which he is employed and not upon his production. If a worker works for an overtime, the wage agreement usually provides that all hours worked in excess of an agreed number are paid for at a higher rate. The time basis wage system for direct labour is found in those industries where:

1. The speed of production cannot be influenced by the energy or dexterity of the worker.
2. The quality of work is of paramount importance.
3. It is difficult to measure the work done by the employee.

From the point of view of the worker, the straight time method has both advantages and disadvantages. Workers have feelings of security and certainty which appeal to them. They can depend upon a definite wage or salary regardless of the amount of work completed or the efficiency of their work, provided it is above the minimum requirements. However, this wage system does not give proper recognition or reward to efficient workers whose productivity is above the average of the other workers. There is little incentive to achieve better or superior performance.

From the employer's view-point, time wage systems are easy to compute and understand and provide economy in time-keeping and payroll recording. But on the other hand, constant supervision is required, otherwise considerable wasted time may be paid for. Among the workers, the inefficient workers receive the same wages as the efficient workers, thus tending to cause dissatisfaction and frustration among the workers and increasing the labour cost per unit produced.

The time basis is still the most popular wage system for workers, such as clerks, accountants, stenographers, factory helpers, members of the supervisory staff and officers whose work cannot be standardised and measured satisfactorily. This is preferred by skilled and efficient workers with whom the quality of work is a more important factor than volume of production.

Piece Work

Under this method, a fixed rate is paid for each unit produced, job performed or number of operations completed, and the worker's wages thus depend upon his output and not upon the time he spends in the factory.

Piece-rates are of advantage to management in the following respects:

1. Managerial supervision is not much needed for production, since each worker assumes responsibility for his own time output.
2. Higher production reduces overhead costs per unit of output.
3. Labour costs can be computed in advance of production with the aid of fixed rate unit or job.
4. Labour control becomes easier by isolating workers whose work is inefficient and below the minimum standard requirements.

Piece work has some limitations too. It attaches more premium to quantity than the quality of work. It has the tendency of increasing imperfections, spoiled work, and detectives and higher depreciation costs result because of considerable wear and tear of plant and machinery. Also, this system does not maintain a regular wage for the employee.

To avoid the limitations of straight or simple piece work system, a guarantee is normally provided in the system that the employee's wages shall not fall below a certain minimum figure. This is known as "Piece-rates with guaranteed day rate". Under this method the worker receives a straight piece-rate for the number of pieces produced, provided that his total wage is greater than his earnings on a time rate basis. When the piece-rate earnings fall below this level, the time rate earnings are paid instead. An alternative form of the

methods is the guaranteed time rate (per hour, day or week), plus a piece-rate payment for output above a stated minimum. Labour cost per piece decreases with increasing production until piece-rate earnings exceed the guarantee, therefore, the labour cost per piece remains constant.

INCENTIVE WAGE PLANS

The basic purpose of an incentive wage is to induce a worker to produce more so that he can earn a higher wage and, at the same time, unit costs can be reduced. Incentive wage plans aim to ensure greater output, to help control over labour costs by minimisation of total cost for a given volume of production and to have a basis for reward from hours served to work accomplished.

Incentive wage scheme has the following objectives:

1. Un-interrupted and higher production without any dispute between the labour and management.
2. Stability in labour turnover.
3. Reducing labour absenteeism.
4. Developing cooperation, mutual trust, attitude of team work among workers and between workers and supervisory staff.
5. Control of labour cost and reduction in labour cost unit of output.
6. Improving administrative efficiency.
7. Accurate budgeting through reliable labour cost information.
8. Generating workers' satisfaction by avoiding work stoppages, slow down, and by providing incentive schemes.

The following are the essentials (desirable characteristics) of a successful incentive wage plan:

1. A wage incentive system should be based upon standards of performance—time and motion studies, job evaluation, and merit rating.
2. The incentive plan should be understood by all employees before installation (or hiring).
3. All direct labour tasks should be on an incentive basis.
4. Only standard or acceptable quality production should be considered while determining the bonus.
5. Once the standard is set, it should not be changed unless the method changes.
6. The incentive programme must be fairly and intelligently administered.
7. It is highly desirable that indirect personnel participate in the incentive plan.
8. A high reward should be paid for performance above standard.
9. Individual incentives should be used wherever it is possible to do so.
10. Minimum wage should be guaranteed to every worker.
11. The views of both employers and employees should be considered while designing incentive schemes.
12. The cost of establishing and operating the incentive plans should be reasonable.
13. The incentive plans should help in standard cost and budgetary control programmes.

Incentive wage plans involve wage rates based upon various combinations of output and time and are known as “differential piece-rates” and “bonus plans” as well. Generally, the following types of incentive plans are used:

1. Taylor Differential Piece-rate System
2. Merrick Differential Piece-rate System
3. Gantt Task Bonus Plan
4. Premium Bonus Plans (Halsey, Halsey-Weir, Rowan, Bedaux, Emersion, etc.)

Taylor Differential Piece-rate System

Under this system there are two wage rates, a low one for output below standard and a higher one for above standard performance. The system aims to discourage below average workers by providing no guaranteed hourly wage and by setting low piece-rates for low level production, and a high rate resulting in high earnings if an efficient level of production is attained. For example, in a factory, workers earn Rs. 240 per eight hour day and that production averages 12 units per hour per worker or Rs. 2.50 per unit. The Taylor system might suggest a pay of Rs. 2 per unit if the worker averaged 14 units or less per hour, but Rs. 3 per unit to workers averaging 15 units or more per hour. The main advantages of the Taylor system are that it provides a strong incentive to the efficient worker, and is simple to understand and operate. But the incentive level may be set so high that it cannot attract most workers.

Merrick Differential Piece-rate System

This is an improvement over the Taylor system and depends on using three rates instead of two as in the Taylor system. Normal piece-rates are paid on output, when it does not exceed 83% of the standard output. 110% of normal piece-rate are paid when the output is between 83% and 100%, and 120% of the normal piece-rate is paid if the output is above 100%.

The Merrick system is useful to highly efficient workers as it provides incentives for higher production. Similarly, it takes into account the less efficient worker who can at least achieve 83% of the standard output. This minimum output is probably achievable by all workers.

Gantt Task and Bonus Plan

This system combines a guaranteed time-rate with a bonus and piece rate plan using the differential piece-rate principle. Remuneration under the plan is computed as follows:

<i>Output</i>	<i>Payment</i>
1. Output below standard (high task)	Time-rate (guaranteed)
2. Output at standard	Bonus @ 20% on the time-rate
3. Output above standard	High piece-rate on worker's whole output

This plan provides incentives and opportunities to those who reach high level production. At the same time it provides security and encouragement to less skilled workers. It is simple to understand and workers are also satisfied in that they receive the total reward for their efforts. A limitation of the plan is the tendency on the part of trade unions to demand a high fixed guaranteed time-rate. But the incentive element of the plan would be lost in case too high a rate is fixed.

Premium Bonus Plans

Under the time-rates basis, any additional production above normal levels benefits the employer, whereas with the piece-rates system the benefit goes to the employee (apart from indirect benefits to the employer). Bonus plans have been developed to produce a compromise, in that any savings are shared between employer and employee. The following are the principal schemes under premium bonus plans.

Halsey Premium Plan

The principle of the Halsey scheme is that the worker receives a fixed proportion of any time which he can save by completing the job in less than the allowed time. The most common fixed proportion is 50% but this can be varied. This plan ensures that the employee receives time wages until he produces in less than standard time. For above standard production, savings are shared with the employer with the result that the rate of increase happens to be lower for the employee. The cost per unit decreases when production exceeds standard.

Halsey-Weir Plan

This plan is also known as the Wier Premium Scheme and is based on a $33\frac{1}{3} : 66\frac{2}{3}$ sharing plan. Under this scheme the total emoluments of a worker are the aggregate of guaranteed hourly wages for actual time worked, plus the amount of bonus at the rate of $33\frac{1}{3}\%$ of the time saved. Bonus is allowed at the same hourly rate at which he shall be paid for actual time worked.

Rowan Plan

This scheme is similar to the Halsey plan in that a standard time is fixed for the completion of a job and the bonus is paid in respect of the time saved. But a ceiling is applied to the size of the bonus. The bonus hours are calculated as a proportion of the time taken which the time saved bears to the time allowed, and is paid for at time-work rates. The bonus may be computed as follows:

$$\text{Bonus} = \frac{\text{Times taken}}{\text{Time allowed}} \times \text{Time saved} \times \text{Time rate}$$

Bedaux Point Plan

Under the Bedaux point plan a guaranteed hourly rate is paid until standard production is attained, and a premium or additional wage is paid for units in excess of standard. Instead of being paid as piece-rate, an hour's work is converted to points by dividing a standard hour's production in units into 60 minutes. In other words, if 10 units are standard, then each unit is 6 points and if 15 units are standard then each unit is 4 points. At standard performance the worker produces a point per minute and for the first 60 points produced in an hour, the worker receives the hourly rate. For excess production, it is common practice to pay the worker 75% of the rate, and the foremen, supervisors and other indirect labour personnel receive 25% of the rate.

Emerson Efficiency Plan

Under the Emerson plan a minimum daily wage is guaranteed and a standard time is determined for each job or operation. During each payroll period a record is kept of the hours worked and the units produced, and the efficiency of each employee is then determined by dividing actual hours into the standard time for the units produced. For example, if the standard is 10 units per hour and a worker produces 320 units in an 80-hour week, the standard time for his output is 32 hours and he has worked at 80% efficiency. Below 67% efficiency, the worker is paid his hourly rate, and from 67% upto 100% efficiency, step bonus rates apply. Above 100% efficiency, an additional bonus of 1% of the hourly rate is paid for each 1% increase in efficiency.

Groups Bonus Schemes

Where a group of workers is collectively responsible for manufacturing a product, it may not be possible to adopt individual incentive schemes. The production of the workers as a whole is measured, and the total bonus determined by one of the individual incentive schemes capable of group application. The computed bonus can then be shared equally, or between workers of different skills in differing specified proportions. A group bonus scheme has the following objectives:

1. Developing collective interest and team spirit among all workers and employees.
2. Developing interest among foremen and supervisors to improve performance.
3. Reducing spoilage in materials consumption.
4. Reducing idle time.
5. Achieving maximum production at minimum cost.
6. Motivating workers to produce more to get bonus on the basis of team performance.

Group bonus schemes may be employed:

1. where individual output cannot be measured, but that of a group of worker can, for example, on a production line.
2. where output depends less upon the efforts of particular individuals, and more upon the combined efforts of a group, department, or even of the whole undertaking; or
3. where the management wishes to encourage a team spirit.

The following types of group bonus schemes are in common use:

Budgeted Expenditure Bonus

In this scheme the value of bonus depends upon savings in actual expenditure as compared with the budget. This scheme can be applied to indirect workers and staff besides direct workers.

Cost Efficiency Bonus

This bonus is allowed for savings in specific costs, for example, labour cost or materials cost.

Priestman System

This is a system used in foundries in which a production standard is fixed every month for the entire work. Where production exceeds the standard, workers receive during the following month additional pay equal to the percentage in output over standard. Where production does not exceed standard, no bonus is paid though time rates are guaranteed.

Towne Gain-sharing System

This method introduced by H.R. Towne in the USA is based on the principle that bonus consists of half the reduction in labour cost below standard. The bonus is divided between foremen and operatives, but as it is generally paid half-yearly it tends to be ineffectual as an incentive to individual effort. The payment to foremen and supervisory staff, however, encourages them to reduce labour costs.

In India, payment of bonus under the Payment of Bonus Act 1965 is compulsory, although the amount of bonus may vary from company to company. A minimum bonus of 8.33% is payable whether a company has earned profit or not. The amount of minimum bonus is generally treated as an item of direct labour cost. However, the amount exceeding the minimum bonus is an appropriation of profit. Bonus linked with productivity is treated as an item of overhead cost.

Profit Sharing and Co-partnership

Profit sharing schemes are schemes in which there is an agreement between the employer and his workers whereby he pays them in addition to wages, a predetermined share of the profits of undertaking. Co-partnership or co-ownership confers upon employees the opportunity to share in the capital of the business and to receive that part of the profits that accrue to their share of ownership. Both profit sharing and co-partnership schemes recognise the contribution of employees in the profit of the business firm.

These schemes, however, suffer from the following limitations:

1. Lazy and inefficient workers share equally with hard-working and efficient workers.
2. When the share is paid to the workers in cash they tend to regard it merely as a bonus, and not as a share of the result achieved jointly by themselves and their employers.
3. It is difficult to determine the share of profits to be given to each worker and there may be a certain amount of distrust about declared profits also.
4. The additional earnings under these plans are relatively small and may appear to the workers totally insignificant.

5. The share of profits to be paid to workers may be reduced by bad management.
6. Distribution of the benefit under schemes is done normally once in a year. Therefore, employees do not have much interest in it.
7. Sometimes, this scheme is restricted to employees who have a specified number of years of service in the factory. Thus, this creates dissatisfaction among the newer and younger employees who also have contributed to the profits of the year.
8. The workers share in the good years, but do not bear their share of losses incurred in other years.

Bonus Schemes for Indirect Workers

Indirect work cannot be measured as accurately as the direct work. If only direct workers are paid on incentive scheme, this may create considerable disappointment among indirect workers. Therefore, incentive schemes may be introduced for indirect workers as well, either to increase the efficiency of the services they provide to direct labour or to induce foremen and supervisory staff to increase department efficiency and to reduce costs.

WORK STUDY

The successful operation of incentive wage schemes depends on making a proper work study. Work study is the study of job, methods and equipment to ensure that the best way to do the job has been followed by a worker. Work study consists of two complementary techniques or methods: (i) methods study, and (ii) work measurement.

Method Study

Method study is done to improve methods of production and to achieve the most effective use of materials, manpower and plant. The following stages are involved in methods study:

1. First of all, work for the purpose of methods study should be selected. Generally, methods study is done in jobs which involve complexity and costly operations.
2. After selecting a particular job or work, details about the work should be gathered, such as purpose, location, sequence, relationship with the other work, methods of working, operators and facilities, etc.
3. After studying the relevant details of a work, an improved method should be developed for effectiveness, efficiency and operational simplicity. Unnecessary operations and activities should be avoided. An improved method might change the location and sequence of work, production methods, layout.
4. The method so developed should be used for the job or work for which it has been designed.
5. Follow-up is necessary to enquire as to whether the improved method is being implemented in practice and to find out deviations, if any.

Methods study ensures efficient and maximum use of resources like material, labour, plant facilities; it improves the production methods by reducing/eliminating the work content and unnecessary methods; and it attains the maximum production which is good for the firm as well as the workers.

Work Measurement

Work measurement aims at determining the effective time required to perform the work. The ineffective, wasteful or avoidable time is separated from effective required time to complete the work. The effective time so established in work measurement can be used for the following purposes:

1. Incentive wage schemes which require time taken for completing a work.
2. Improving utilisation of men, machines and materials.
3. Assisting in production control.
4. Setting labour standards.
5. Achieving the objectives of cost control and cost reduction.

The following stages are involved in work measurement:

1. Selection of the work.
2. Measuring the actual time taken in the work done.
3. The total time so established for a job should be adjusted for fatigue, time taken in setting the tools, idleness involved in the work itself, etc.

The standard time is further considered to know the time saved under incentive schemes and to determine the wage rate at the incentive level. This is explained with the help of the following example:

	<i>Minutes per job</i>
Time before incentive schemes	50
Allowances 10%	5
Basic or standard time	55
Time saved under incentive conditions (20%)	11
Time under incentive conditions	44

JOB EVALUATION AND MERIT RATING

Job Evaluation

Job evaluation is the technique of analysis and assessment of jobs to determine their relative value within the firm so that a fair wage and salary structure can be established for the various job positions. In other words, job evaluation aims at providing a rational and equitable basis for differential salaries and wages for different classes of workers. Following are the objectives (or benefits) of job evaluation:

1. It aims at developing a systematic and rational wage structure as well as job structure.
2. It aims at establishing consistency between the wage and salary structure adopted within the firm and that of other firms within the industry or geographical area.
3. Controversies and disputes relating to salary between the employers and employees can be settled by designing job evaluation techniques within the firm which can satisfy employers and employees both.
4. Wage and salary structure established on the basis of job evaluation will be fair, reliable and satisfying to the employees. Employees' skills, efforts, competence are properly considered in determining wage rates.
5. Stability and fairness in the wage and salary structure are very useful for the administration which can formulate business policies and plans as workers cooperation is fully ensured.
6. Job evaluation discloses characteristics and conditions relating to different jobs and these job requirements are very helpful at the time of recruiting the workers. The employment department can appoint only those workers who are found suitable in terms of such job requirements.

Methods of Job Evaluation

Methods of job evaluation can be listed as follows:

Point Ranking Method

Under this method each job is analysed in terms of job factors. Job factors may consist of elements like skill, effort, working conditions, hazards, responsibility. However, different job factors may emerge in different jobs. After specifying job factors, each of them is assigned weightage or points depending on its value for the job. For example, in a particular job, education may be given the higher point as compared to supervision, if the job requires a high degree of education. Finally, the jobs are ranked in the order of points or weights secured by them. Grades are further developed for these different weightages so that wages rates or wage structure can be suitably designed for them. For example, the following wage scales can be worked out depending on the weights grade.

<i>Weights or points</i>	<i>Grade</i>	<i>Salary scale (Rs.)</i>
50-100	I	10000-15000
151-200	II	15000-20000
201-250	III	20000-30000
251-300	IV	30000-40000
301-350	V	40000-50000
351-400	VI	50000-60000
401-450	VII	60000-80000
451-500	VIII	80000-100000

This method is theoretically sound and objective, but it is difficult to operate. The relative weights and points of different job factors need to be developed very carefully and in an objective manner.

Ranking Method

The ranking method only requires that different jobs in an organisation should be rearranged in an order which can be done either from the lowest to the highest or in the reverse. Before doing ordering of jobs, all jobs should be properly studied in terms of job requirements, worker's qualification, responsibilities, working conditions, etc. Finally, wage scales are determined in terms of ranks.

This method is very simple to operate, less costly and easy to understand. However, this method may be useful for small organisations only, where jobs are few and well defined. But in a large organisation where jobs are complex and highly involved, this method cannot be beneficial.

Grading Method

This method is an improvement over the ranking method. Under this method, a hypothetical scale or standard of job values is determined and each job after being analysed in terms of a predetermined grade, is given a grade or class. Predetermined grades or yardsticks are formulated after examining existing jobs in the enterprise. The grades or the class should be established after making an investigation of job factors, such as complexity in the job, supervision, responsibility, education, etc.

This method is simple, less costly and administratively feasible. It attempts at applying a rational basis for grading jobs.

Merit Rating

Merit rating is the comparative evaluation and analysis of the individual merits of the employees. It analyses the differences in performance between employees who are working on similar jobs and would therefore earn the same wages. In this task, merit rating accomplishes more than job evaluation. Merit rating has the following objectives:

1. To evaluate the merit of an employee for the purpose of promotion, increment, reward and other benefits.
2. To establish and develop a wage system and incentive scheme.
3. To determine the suitability of an employee for a particular job.
4. To analyse the merits (or demerits) of a worker and help him in developing his capability and competence for the job.

The characteristics and factors that are considered in merit appraisal of the workers are the following:

1. Cooperation
2. Quality of work done
3. Attendance and regularity
4. Education, skill, experience
5. Character and integrity
6. Initiative

Merit rating is beneficial to the business enterprise and the workers. It increases the output, improves labour-management relations and encourages workers to have fair competition among themselves. However, merit rating has the following drawbacks;

1. The rating of employees may be subjective and this creates dissatisfaction among them.
2. Evaluators or raters tend to give much premium to past ratings of an employee who might have improved himself in the course of time.
3. Rates may be influenced by raters' own attitudes and self-made rating factors which are not consistent with the merit rating process. Incentives schemes may not be introduced advantageously if merit rating is inaccurate, unreliable and subjective.

Differences Between Job Evaluation and Merit Rating

Job evaluation and merit rating differ on the following counts:

1. Job evaluation is the assessment of the relative worth of jobs within a business enterprise and merit rating is the assessment of the relative worth of an employee with respect to a job. In other words, job evaluation rates the jobs, but merit rating rates employees on their jobs.
2. Job evaluation helps in establishing a rational wage and salary structure. But merit rating helps in fixing fair wages for each worker in terms of his competence and performance.
3. Job evaluation brings uniformity in wage and salary rates. But merit rating aims at providing a fair rate of pay for different workers on the basis of their performances.

TIME AND MOTION STUDY

Time study determines the time spent on each element of a job. The total time taken by all elements (stages) of a job is called the standard time. This standard time is the time which should be taken by an average employee to complete a job under standard (normal) working conditions.

Motion study implies dividing the work into fundamental elements or basic operations of a job or a process for the purpose of eliminating unnecessary (defective) elements or operations in a job. After investigating all movements in a job, process, or operation, it finds out the most scientific and systematic method of performing the operation or completing the job. Thus, time study fixes the standard time for a job or process, and motion study eliminates wasteful motions or the movement of a worker on the job. Both are complementary to each other.

Objectives

Following are the objectives of time and motion study:

1. Eliminating unnecessary motions, fatigue and improving human efforts.
2. Improving method, procedure, techniques, process relating to a job.
3. Utilising effectively materials, machines, human resources and other facilities.
4. Improving working environment, layout and design of plant and equipment.

Benefits

Time and motion study is quite beneficial to the management in the following respects:

1. Proper and fuller utilisations of materials, plant, labour and other resources.
2. Help in assessment of labour requirements.
3. Setting of labour cost standards and control of the labour cost.
4. Determination of fair wage rates and effective wage incentive schemes.
5. Preparation of labour budgets.
6. Standardising jobs, equipments, methods by determining the best method of operating in the time set.
7. Improvement in work methods by comparing the time taken to complete the same type of work under different possible methods.
8. Proper planning and effective cost control.

LABOUR TURNOVER

Labour turnover is the rate at which employees leave employment at a factory and is normally measured as the ratio of the number of persons leaving in a period to the average number on the payroll. For example, if 100 persons leave a company in a year and the average number on the payroll is 500, labour turnover is expressed as 20% p.a. In this calculation all persons who leave must be included, whether they leave voluntarily or are dismissed and irrespective of whether they are replaced. There are three methods of measurement of labour turnover.

1. $\frac{\text{All employees leaving}}{\text{Average number employed}} \times 100$
2. $\frac{\text{Number of replacements in a period}}{\text{Average number employed}} \times 100$
3. $\frac{\text{All employees leaving plus new employees}}{\text{Average number employed}} \times 100$

Among the three methods, the first method is to be preferred, as it is more appropriately a long-term indicator. This formula is more satisfactory as management is primarily concerned with the loss of labour, after money has been spent on training. The effects of a high or low turnover rate should then be analysed, e.g., on training costs, on production efficiency and employee morale.

Causes of Labour Turnover

Labour turnover is caused by many factors which may be listed as follows:

Avoidable Causes

These causes may be eliminated by taking suitable measures by the business firm. Avoidable causes are the following:

1. Low wages and earnings.
2. Unsatisfactory working conditions.
3. Bad relations among workers and between workers and supervisor.
4. Existence of rival trade unions in the organisation.
5. Unsuitability of job.
6. Lack of conveyance, accommodation, medical, educational facilities, recreational amenities, etc.

Unavoidable Causes

Sometimes, workers have to leave the organisation because of management requirements and actions. These are known as unavoidable causes and may be described as follows:

1. Termination of service due to misbehaviour, indiscipline, etc.
2. Retrenchment or lay off due to shortage of resources, low demand, seasonal nature of business.

Personal Causes

Sometimes workers leave the organisation at their own will and management can do nothing in this regard. These are known as personal factors which are the following:

1. Change for better job
2. Death
3. Retirement due to old age and ill health
4. Family troubles and constraints
5. Change for a better place, environment.

Cost of Labour Turnover

The cost of labour turnover consists of two elements:

1. Preventive costs
2. Replacement costs

Preventive Costs

Preventive costs include all those costs which are incurred to prevent workers from leaving the organisation and keeping them satisfied. Preventive costs may broadly be of the following types:

1. Personnel administration A part of personnel administration costs may be incurred to establish a good relationship between the management and the employees and to remove workers' grievances. These costs are known as preventive costs.

2. Medical and health care The costs incurred for providing medical benefits to the workers and their families are included in the labour turnover costs.

3. Welfare measures Welfare measures include facilities like sports, educational facilities, transport, housing, cooperative stores, canteens. The availability of those facilities prevent workers from leaving the organisation and keep them satisfied.

4. Wage and retirement benefits These include facilities like pension, provident fund, gratuity, bonus, incentive schemes. If an organisation has provided these benefits, the rate of labour turnover will be appreciably reduced.

Replacement Costs

Replacement costs include the costs which are incurred for the recruitment and training of new workers. Also, they cover costs which arise as a result of wastages, losses, lower production because of less competent and inexperienced new employees. Broadly, they include the following items:

1. *Personnel department expenses* The personnel department has to recruit new workers in case of high labour turnover and therefore the costs of the personnel department goes up.
2. *Cost of training of new workers* New workers are first to be given necessary trainings before they are given regular jobs. Also, production time is lost during the training of the workers.
3. *Inefficiency of new workers* New employees are comparatively less efficient and therefore, production is adversely affected.
4. *Delay in getting new workers* It takes time to find new workers who will be suitable for the jobs. In the meantime, existing employees may be given overtime which is again a burden on the organisation.
5. *Cost of breakages of tools and equipments* New workers, being inexperienced, break more tools than the old experienced workers. Sometimes, machine break-down may occur and hamper production.
6. *Costs of spoilage and defectives* More spoilage and defectives are likely to occur due to mishandling and carelessness of the new workers. The greater the spoilage and defectives, the larger will be the cost of production.

Measures to Reduce Labour Turnover

Turnover can rarely be traced to one single cause and is usually the result of a combination of a number of causes. The management after knowing the reasons for labour turnover should frame suitable policies and take action to reduce the turnover rate. An appropriate Labour Turnover Accounting can be adopted to manage labour turnover efficiently and effectively. Labour turnover accounting implies the identification, measurement and monitoring of labour turnover data. More specifically, this would include the regular cost measurement of labour turnover and the implementation of a labour turnover cost control programme. Knowledge about the true costs of labour turnover will stimulate management to take appropriate action to reduce its cost.

Job enrichment, "human relations" training for managers, and effective communication throughout the company are vital in reducing labour turnover. Job enrichment means that jobs should, wherever possible, be restructured so that employees have opportunities to increase their skill, use their initiative and assume more responsibility for their work.

Managers should be given training in "human relations" and "management". Any improvement in personnel relations between management and employees will not only bring out improvement in industrial relations within the company but will also reduce the rate of labour turnover.

Furthermore, effective communication throughout the business firm will help control the high rate of labour turnover. There is great need to provide people with information on the affairs of the enterprise where they are working and on matters affecting their working conditions and future employment prospects.

TREATMENT OF LABOUR COST-RELATED ITEMS

Overtime

Overtime is the time put in by employees and work done by them beyond normal hours of work. According to the Factories Act 1948, every worker is to be paid overtime at a higher rate, generally at double the normal wage rate, if he is required to work for more than 8 hours a day. In case the Factories Act is not applicable in some situations, it is the practice to pay to workers for overtime work at higher rate. The excess over normal

wage rate is called overtime premium. In cost accounting, the overtime premium is separated from regular earnings and consideration must be given to the reasons for the overtime payment to decide as to how they should be treated in cost accounts.

Treatment of Overtime Premium

The treatment of overtime premium is decided in terms of factors and reasons which has caused overtime work. They are explained as follows:

1. Accepting rush orders which can not be finished in regular working hours and therefore, overtime work becomes necessary. In this case, since the overtime work is due to one particular order, the overtime premium should be charged to that particular order or job. Also, payment for such overtime work should be recovered from the customer who has given such an order. That is, the contract price for the job would include the overtime premium factor.
2. Scheduling more production than can be completed in normal working hours. For example, a company with a normal capacity of 8000 units to be completed in 800 labour hours decides to produce 10,000 units which require 1000 labour hours, 200 overtime hours are necessary. Such overtime work may be caused due to temporary higher demand, higher seasonal demand or due to company's own decision for additional production. In this case, the overtime premium will be charged to each of 10000 units completed during the period. Overtime premium cannot be charged to only 2000 units that have to be completed after regular working hours.
3. Overtime work may become necessary because of abnormal circumstances, that is, factors which are beyond the control of management, such as fire, flood, etc. In this case, the overtime premium is transferred to Costing Profit and Loss A/c and is not charged to the units or jobs completed.
4. Overtime work may be caused due to fault, delay of another department in the organisation. In this case, the overtime premium is charged to the department which is at fault or is responsible for the delay.

Overtime payments made to workers engaged in direct labour are treated as direct labour cost and charged to the jobs or units completed. Overtime payments made to indirect labour are the part of factory overheads, overtime payments made to the staff of administrative departments are treated as administrative overheads and overtime payments made to the staff of selling and distribution departments are treated as selling and distribution overheads.

Idle Time

Where workers are remunerated on a time basis some difference between the time for which they are paid and that which they actually spend upon production is bound to arise. This difference is known as idle time, and represents the time for which the employer must pay but from which he obtains no direct advantage. Idle time does not include holidays, leave, etc. Idle time may be normal or abnormal.

Normal Idle Time

Normal idle time is that idle time which is unavoidable, of normal nature and is inherent in a production or work environment. Normal idle time is caused by factors such as:

1. Time lost in moving from one job to another.
2. Time lost in waiting for materials or instructions.
3. Time taken in getting from the gate of the factory to the department in which the worker is engaged and the reverse journey at the end of the day.
4. Temporary absences from duty because of minor accidents, personal needs, tea-breaks, etc.

The wastage of time due to the above factors cannot be avoided and therefore idle time must be accepted as implied in production. Under the above situations idle time will be of normal variety and constitute a legitimate charge to factory overhead. Thus, payment made for idle time is part of the cost of a product or job.

Abnormal Idle Time

Abnormal idle time is that time which is not caused by or connected with the usual routine of manufacture. The time wasted may represent abnormal idle time. The loss (or expenses) incurred and caused by abnormal conditions, cannot be regarded as part of the cost of the product and should be transferred to the costing profit and loss account. Examples of abnormal idle time would be:

1. Time lost through the break down of machinery due to the inefficiency of the works engineers or to the failure of the power supply.
2. Time lost through lack of materials occasioned by the slackness of the store-keeper in notifying the buying department of his requirements.
3. Bottlenecks in production, resulting in a temporary absence of parts for further processing.
4. Strike, lock-out, fire, wind, water damage, etc.

Fringe Benefits

An employee's salary or wage normally consists of basic wages, dearness allowance, house rent allowance, city compensatory allowance, etc. Besides the salary, workers are provided some indirect cash or fringe benefits, such as vacation and holiday pay, workmen's compensation insurance, pension costs, hospitalisation benefits, group insurance, sick pay, overtime and night shift premium, profit sharing bonus. These indirect benefits constitute fringe benefits. They tend to improve employee morale, loyalty and stability. The cost of these benefits are treated as a direct charge to production by using a supplemental wage rate. Alternatively, they are treated as factory overhead.

Shift Premium

Payment of higher hourly rates for evening and night shifts is a common feature. Treatment of shift premium follows the same reasoning as overtime premium. Where shift premium is needed to meet the requirements of a particular order or job, the additional cost should be charged to the job concerned and is accordingly excluded from production overhead. When shift premium is incurred in order to increase the output as a whole, the premium element should be separated from direct wages and treated as a production overhead. In this case similar operations should carry the same cost, regardless of when they were performed and should be spread over all units manufactured.

Holiday and Vacation Pay

Most employees are entitled to statutory holidays or compulsory holiday such as Independence day, Republic day, etc. Payments which are made to an employee while he is absent on vacation and holidays, are accrued monthly and spread out over the year's production. The total amount is charged to the full year's overhead expense. In this way no single period is forced to carry the whole burden. This should not be treated otherwise because the number of holidays vary from month to month. If the expenses are apportioned monthly on the month's production, the cost of production in a particular month would be too heavy as compared with the costs in other months, when there are no holidays.

Alternatively, an inflated rate of direct wages can be used to absorb both the normal weekly wages and the appropriate part of holidays.

Learner's or Apprentices' Wages

In many plants new workers receive some preliminary training before they can become economically productive. Apprentices generally take more time than skilled workers to perform a given task and they are likely to cause more scrap. On the other hand, they are paid a lower rate per hour. The wages of workers under training who cannot normally make any real contribution to production, should be treated as production overhead and should be charged to the annual output through inclusion in the factory overhead rates.

In case of unusual training programmes due to the opening of a new plant or the activities of a second or third shift, a case can be made for treating the training cost as development or starting load cost and deferring a portion of the cost over a considerable period of time or over the life of the contract.

Attendance Bonuses

Sometimes workers who perform the full number of shifts in a working week, or who lose no time over a stated period, are entitled to an attendance bonus. Such bonuses are part of wages and sometimes are treated as direct wages and charged by means of an inflated direct wages rate. Alternatively, they may be treated as a production overhead. In process or contracting industries, they may properly be charged direct to the process concerned.

Leave with Pay

In a factory, workers are entitled to annual leave with full pay for some days in a year. Besides, medical leave, casual leave, earned leave, special leave, etc. are also available. It is not generally treated as a direct charge to a product or job but as factory overhead and recovered through departmental overhead rates. Alternatively, an inflated rate of direct wages cost can be applied to absorb both normal wages and an appropriate portion of leave with pay.

Employer's Contribution to Insurance

The employer's share of insurance for the employees engaged in manufacturing is treated as production overhead. When a contractor's employees tend to remain on one job for many weeks at a time, it is possible to treat the contributions as a direct charge to the contract concerned. In the case of process workers too, it is frequently possible to charge insurance contributions direct to the process. Also, an inflated direct labour rate can be employed so as to absorb the contributions, but this practice is rarely followed.

Casual Workers

Casual workers should be issued clock cards to show the number of hours worked. If casual workers are engaged on specific production or jobs, they should be treated as direct charge to the specific production. If these workers are performing indirect work, it should be treated as overhead expense. Due care should be exercised by the wage department in making payment to casual workers. The clock cards should be properly signed by the foremen and forwarded to the wages department for payment.

Out-Workers

In some trades, for example, in knit wear and in manufacturing lampshades certain work is performed by workers in their own homes. In such cases there is no need to maintain time records as the workers are paid according to the work they complete. However, control should be exercised over out-workers in the following respects.

1. Issue of materials to out-workers and its comparison with the finished output.
2. Inspection of the output and rejection of the defective work.
3. Return of the output within the agreed time so as to fulfil customer's orders and contracts.

Outside Workers

Outside workers are employees working outside the factory on building sites or moving from place to place on small installations or repair work. If these employees report to the factory first for instructions, their arrival times can be recorded. But if they go direct to the site, it may be necessary for them to complete their own time sheets with some supervision or check on the times. For example, a foreman may travel from site to site or the customer may be asked to sign the time sheet which will form the basis of a charge to him. Where a large number of workers are engaged upon a site for a long period, for example, on a civil engineering contract, it is usual for time recording clocks to be installed at the site. When casual workers are engaged for outside work, a head office clerk should attend to pay these workers. Alternatively, the foreman may be issued a petty cash fund from which to make the payments.

Example 5.1

Standard time allocated for a job is 20 hours and the rate per hour is Re. 1 plus a dearness allowance @ 0.30 paise per hour worked.

Actual time taken by a worker is 15 hours.

Calculate earnings under:

- time-wage system;
- piece-wage system;
- Halsey plan;
- Rowan scheme.

(B.Com., Delhi, 2004)

Solution:

(a) Time Wage System:

	Rs.
Basic wages for 15 hours @	15.00
Re. 1 per hour	
Dearness Allowance (D.A.) for 15	4.50
hours @ 30 p. per hour	
	19.50

(b) Piece Wage System:

Basic wages for 20 hours	20.00
@ Re. 1 per hour	
D.A. for 15 hours	
@ 30 p. per hour	4.50
	24.50

Note: Piece wages are calculated on the time allocated + D.A for the hours worked.

(c) Halsey Plan:

Basic wage for 15 hours	
@ Re. 1 per hour	15.00
Dearness allowance for 15 hours	
@ 30 p. per hour	4.50
Bonus = 50% of time saved × time rate	
= (50% × 5 hours × Re. 1)	2.50
	22.00

(d) Rowan Scheme:

	Rs.
Basic wages for 15 hours @	15.00
Re. 1 per hour	
Dearness allowance for 15 hours	
@ 30 p. per hour	4.50
Bonus*	3.75*
	23.25

where,

 T = Time taken (actual time) S = Standard time (time allowed) R = Rate per hour

$$* \text{Bonus} = \frac{S - T}{S} \times T \times R$$

$$\begin{aligned} \text{Bonus} &= \frac{20 - 15}{20} \times 15 \times 1 \\ &= \frac{5}{20} \times 15 = \text{Rs. } 3.75 \end{aligned}$$

Example 5.2

From the following particulars, find the amount of cash required for payment of wages in a factory for a particular month:

	Rs.
1. Wages for normal hours worked	40,000
2. Overtime wages	10,500
3. Leave wages	5,000
4. Contribution to Provident Fund:	
Employee's share	4,000
Employer's share	3,500
5. House rent to be recovered from 10 employees @ Rs. 200 per month.	

*(B. Com. (Hons), Delhi, 2005)***Solution:**

Computation of cash required for payment of wages

	Rs.	Rs.
(i) Wages for normal hours worked		40,000
(ii) Overtime wages	10,500	
(iii) Leave wages	5,000	15,500
Total	55,500	
<i>Less: Deductions</i>		
(i) Employee's share (P.F.)	4,000	
(ii) House Rent to be recovered (Rs. 200 × 10)	2,000	6,000
Cash required	49,500	

Example 5.3

A worker is paid Rs. 50 per hour and the 5 days working week contains 42 hours. The daily allowance for approved absence from his place of work, maintenance of machine etc. is 12 minutes and his job card shows that his time chargeable during the week to various jobs is as follows:

Job No.	305	20 hrs.
Job No.	310	10 hrs.
Job No.	320	8 hrs.

The unaccounted time is caused by a power failure. Show how his wages for the week would be dealt with in cost accounts. *(B.Com. (Hons.), Delhi 2003)*

Solution:

Total wages payable to the worker for the week = Rs. 2100 (42 hrs @ Rs. 50 per hour)

Worker's wages are to be dealt with in the cost accounts as follows:

	Rs.
Wages chargeable to Job No. 305 (20 hours @ Rs. 50)	1000
Wages debited to Job No. 310 (10 hours @ Rs. 50)	500
Wages debited to Job No. 320 (8 hours @ Rs. 50)	400
Wages for approved absence for 5 days @ 12 minute per day taken as normal idle time to be recovered as factory overhead (1 hour wages @ Rs. 50)	50
Wages for time wasted due to power failure taken as abnormal loss transferred to costing profit and loss account (3 hours @ Rs. 50) (Hour 42 – 20 – 10 – 8 – 1 = 3 hrs.)	150

Example 5.4

XYZ Co. employs its workers for a single shift of 8 hours per day for 25 days in a month. The Company has recently fixed the standard output of 40 units per day per worker for a mass production item and introduced an incentive scheme to boost output. Details of wages payable to the workers are as follows:

- (i) Basic wages : Rs. 3 per unit subject to a guaranteed minimum wages of Rs. 80 per day worked.
- (ii) Dearness allowance : Rs. 40 per day worked.
- (iii) Incentive bonus :
- Upto 80% efficiency : Nil
- For efficiency above 80% : Rs. 50 for every 1% increase above 80%.

The details of performance of 2 workers for a particular month are as follows:

Workers	No. of days worked	Output (units)
A	25	820
B	18	500

Calculate the total earnings of both the workers for the month.

(B.Com.(Hons), Delhi, 2004)

Solution:**Statement of Total Earning of each worker**

Workers	Days Worked	Output	Basic Wages	Dearness Allowance	Incentive	Total Earnings
A	25	820 units	2460	1000	100	3560
B	18	500 units	1500	720	—	2220

Workers	Efficiency	Incentive @ Rs. 50 for each 1% in efficiency above 80%
A	$\frac{820}{25 \times 40} = 82\%$	Rs. 100 (@ Rs. 50 for one percent)
B	$\frac{500}{18 \times 40} = 69\%$	Nil

$$\text{Efficiency} = \frac{\text{Actual output units}}{\text{No. of days worked} \times \text{Rs. 40}} \times 100$$

Example 5.5

A factory has a piece-work scheme for mass production of a certain component for a T.V. manufacturer. The standard production fixed for a day of 8 hours is 40 units. The piece work rate is Rs. 4 per piece. The details of remuneration payable to the workers are as follows:

Production efficiency	Wages	Dearness allowance	Incentive bonus
Upto 80%	Per week wages @ Rs. 4 per piece subject to guaranteed minimum wages of Rs. 100/day	Rs. 60/ day	Nil
Above 80%	-do-	-do-	Rs. 40/- for every 1% increase in efficiency above 80%

Three workers Ram, Salim, Tom gave the following performance for May 2007:

Name of the worker	No. of days worked	Output (units)
Ram	20	480
Salim	24	864
Tom	25	1,100

Calculate their total earnings.

(I.C.W.A., Inter, Stage I, June 2007)

Solution:

The earnings are worked out as follows:

Name of worker	No. of days worked	Actual output	Standard output	Efficiency (%)	Basic Wages (Rs.)	D.A (Rs.)	Incentive Bonus (Rs.)	Total (Rs.)
Ram	20	480	800	60%	2000 (min)	1200	—	3200
Salim	24	864	960	90%	3456 (P.W)	1440	400	5296
Tom	25	1100	1000	110%	4400 (P.W)	1500	1200	7100

Basic Wages = Actual output × Rs. 4 per piece

In case of Ram it will be minimum that is.

20 days × Rs. 100 = Rs. 2,000

Incentive Bonus =

Salim @ Rs. 40 for 1%, total for 10% (90% – 80%)

Tom @ Rs. 40 for 1%, total for 30% (111% – 80%)

Example 5.6

The standard labour time required for the production of a certain component has been fixed as 4 hours. An incentive scheme was introduced recently to raise labour productivity. The relevant details of the scheme are as follows:

Efficiency	Incentive as a percentage of basic wages
Below 100%	No incentive
100% (that is, 4 hrs/unit)	10%
Above 100%	1% additional incentive for every 1% increase in efficiency above 100% fractions excluded.

Four workers A, B, C and D produced 16, 12, 14 and 10 units respectively in a particular week of 48 hours. The basic wages of all the workers is Rs. 15 per hour.

Calculate the efficiency, incentive bonus, total earnings and labour cost per unit in respect of each of the above four workers. (I.C.W.A. Inter, Stage 1), Dec. 2003)

Solution:

Calculation of Efficiency and Incentive Bonus

A	16 × 4	64	48	133	43
B	12 × 4	48	48	100	10
C	14 × 4	56	48	116	26
D	10 × 4	40	48	83	—

Computation of Total earnings per worker and labour cost per unit of component

Worker	Basic wages		Incentive		Total earnings	No. of units produced	Labour cost per unit
	Rs.	%	Rs.	Rs.			
A	720.00	43	309.60	1029.60	16	64.35	
B	720.00	10	72.00	792.00	12	66.00	
C	720.00	26	187.20	907.20	14	64.80	
D	720.00	—	—	720.00	10	72.00	

Basic wages: 48 hours × Rs. 15 = Rs. 720

$$\text{Labour cost per unit} = \frac{\text{Total earnings}}{\text{No. of units produced}}$$

Example 5.7

From the following particulars, you are required to work out the earnings of a worker for a week under

- (i) Straight Piece Rate;
 - (ii) Differential Piece Rate;
 - (iii) Halsey Premium Scheme (50% sharing) and
 - (iv) Rowan Premium Scheme:
- | | |
|-----------------------------|--|
| Weekly working hours | 48 |
| Hourly wage rate (Rs.) | 7.50 |
| Piece rate per unit (Rs.) | 3.00 |
| Normal time taken per piece | 24 minutes |
| Normal output per week | 120 pieces |
| Actual output for the week | 150 pieces |
| Differential piece rate | 80% of piece rate when output is below normal and 120% of piece rate when output above normal. |

(I.C.W.A. Inter June 1999)

Solution:

Computation of Workers' weekly earning under Different Wage Plans

(i) *Straight Piece Rate*

$$= \text{Weekly Output} \times \text{Piece Rate per unit}$$

$$\text{Earnings} = 150 \text{ units} \times \text{Rs. } 3 = \text{Rs. } 450$$

(ii) *Differential Piece Rate*

$$\text{Efficiency level achieved} = \frac{150 \text{ pieces}}{120 \text{ pieces}} \times 100 = 125\%$$

The efficiency Level achieved is more than 80%. Hence, a high differential piece rate (that is, at 120%) is applicable that is, (Rs. 3 × 120%) = Rs. 3.60 per piece

$$\text{Earnings} = 150 \text{ pieces} \times \text{Rs. } 3.60 = \text{Rs. } 540$$

(iii) *Halsey Premium Scheme (50% sharing)*

$$\text{Standard Hours for Actual Production} = (48/120) \times 150 = 60 \text{ hours}$$

$$\text{Time Saved} = 60 \text{ hours} - 48 \text{ hours} = 12 \text{ hours}$$

$$\text{Earnings} = \text{Hours Worked} \times \text{Rate per hour} + 1/2 \text{ of time saved} \times \text{Rate per hour.}$$

$$= 48 \times \text{Rs. } 7.50 + 1/2 \times 12 \times 7.50 = \text{Rs. } 360 + \text{Rs. } 45$$

$$= \text{Rs. } 405$$

(iv) *Rowan Premium Scheme*

$$\text{Earnings} = \text{Hours Worked} \times \text{Rate per hour} + \frac{\text{Time Saved}}{\text{Time Allowed}} \times \text{Time Taken} \times \text{Rate per hour.}$$

$$= 48 \times \text{Rs. } 7.50 + 12/60 \times 48 \times \text{Rs. } 7.50$$

$$= \text{Rs. } 360 + 72 = \text{Rs. } 432$$

Example 5.8

In a manufacturing unit, a multiple piece rate plan is operated as under:

- (i) Basic piece rate up to 85% efficiency;
- (ii) 115% basic piece rate between 90% and 100% efficiency;
- (iii) 125% basic piece rate above 100% efficiency.

The workers are eligible for a "Guaranteed Day Rate" which is equal to 75% efficiency and the piece rate is Rs. 2.00 per piece.

Compute the labour cost per piece at 5% intervals between 65% and 125% efficiency, assuming that at 100% efficiency 60 pieces are produced per day. (I.C.W.A. Inter Dec. 1997)

Solution:**Computation of Labour Cost Per Piece**

Efficiency %	Output per day (units)	Piece Wage @ Rs 2 per piece	Guaranteed Time wages per day Rs.	15% Additional piece wage Rs.	25% Additional piece wage Rs.	Total Labour Cost Rs.	Labour Cost per piece Rs.
65	39	78	90	—	—	90.00	2.31
70	42	84	90	—	—	90.00	2.14
75	45	90	90	—	—	90.00	2.00
80	48	96	—	—	—	96.00	2.00
85	51	102	—	—	—	102.00	2.00
90	54	108	—	16.20	—	124.20	2.30
95	57	114	—	17.10	—	131.10	2.30
100	60	120	—	18.00	—	138.00	2.30
105	63	126	—	—	31.50	157.50	2.50
110	66	132	—	—	33.00	165.00	2.50
115	69	138	—	—	34.50	172.50	2.50
120	72	144	—	—	36.00	180.00	2.50
125	75	150	—	—	37.50	187.50	2.50

Working Notes:

1. The guaranteed time wage is payable at 75% efficiency. Hence, the time wages of Rs. 90 per day is payable for efficiency up to 75%.
2. Normal piece wages are payable at 80% and 85% efficiency levels.
3. At efficiency levels between 90% and 100%, additional 15% of the piece wages have been allowed.
4. At efficiency levels above 100%, additional 25% of the piece wages have been allowed.

Example 5.9

A worker produced 200 units in a week's time. The guaranteed weekly wage payment for 45 hours is Rs. 81. The expected time to produced one unit is 15 minutes which is raised further by 20% under the incentive scheme. What will be the earnings per hour of that worker under Halsey (50% sharing) and Rowan bonus schemes? (CA, PE, Exam II, Group II, May 1995)

Solution:**Earning per hour under Halsey (50% sharing) Bonus Scheme**

$$\begin{aligned} \text{Time allowed for actual weekly production} &= \frac{200 \text{ units} \times 18 \text{ minutes}}{60 \text{ minutes}} \\ &= 60 \text{ hours} \end{aligned}$$

$$\begin{aligned} \text{Time saved} &= \text{Time allowed} - \text{Actual time taken} \\ &= 60 \text{ hours} - 45 \text{ hours} = 15 \text{ hours} \\ \text{Earning} &= (\text{Hours worked} \times \text{Rate per hour}) + 1/2 (\text{Time saved}) \times \text{Rate per hour} \\ &= 45 \text{ hours} \times \text{Rs. } 1.80 + 1/2 \times 15 \text{ hour} \times \text{Rs. } 1.80 \\ &= \text{Rs. } 81 + \text{Rs. } 13.50 = \text{Rs. } 94.50 \\ \text{Earnings (per hour)} &= \frac{\text{Rs. } 94.50}{45 \text{ hours}} = \text{Rs. } 2.10 \text{ per hour} \end{aligned}$$

Earnings per hour under Rowan Bonus Scheme

$$\begin{aligned} \text{Earnings} &= \text{Hours worked} \times \text{Rate per hour} + \frac{\text{Time saved}}{\text{Time allowed}} \times \text{Time taken} \times \text{Rate per hour} \\ &= 45 \text{ hours} \times \text{Rs. } 1.80 + \frac{15 \text{ hours}}{60 \text{ hours}} \times 45 \text{ hours} \times \text{Rs. } 1.80 \\ \text{Earnings per hour} &= \frac{\text{Rs. } 101.25}{45 \text{ hour}} = \text{Rs. } 2.25 \text{ per hour} \end{aligned}$$

Working Notes:

1. Expected time to produce one unit under incentive scheme = 15 + 20%
= 18 minutes
2. Wage rate per hour (Rs. 81/45 hours) = Rs. 1.80

Example 5.10

Three workers Govind, Ram and Shyam respectively produced 80, 100 and 120 pieces of product X on a particular day in May 2007 in a factory. The time allowed for 10 units of product X is 1 hour and their hourly rate is Rs. 4. Calculate for each of these three workers the following:

- (i) Earnings for the day, and
- (ii) Effective rate of earnings per hour under:
 - (a) Straight Piece Rate
 - (b) Halsey Premium Bonus (50% sharing) and
 - (c) Rowan Premium Bonus Method of Labour Remuneration

*(ICWA, Inter)***Solution:**

A day has been assumed of 8 working hours

(a) Straight Piece Rate

Workers	Hours worked	Output units	Piece rate (Rs.)	Earnings for the day (Rs.)	Effective rate of earnings per hour (Rs.)
Govind	8	80	0.40	32	4
Ram	8	100	0.40	40	5
Shyam	8	120	0.40	48	6

$$\text{Price rate} = \frac{\text{Hourly rate}}{\text{Standard output per hour}} = \frac{\text{Rs. } 4}{10} = \text{Re. } 0.40$$

(b) Halsey Premium Plan (50% sharing)

Workers	Hours worked	Output units	Time allowed (hours)	Time saved (4 - 2)	Time rate (Rs.)	Basic wages (Rs.)	Bonus (Rs.)	Earnings for the day (7 + 8)	Effective rate per hour (Rs.)
1	2	3	4	5	6	7	8	9	10
Govind	8	80	8	0	4	32	0	32	4.00
Ram	8	100	10	2	4	32	4	36	4.50
Shyam	8	120	12	4	4	32	8	40	5.00

Notes:

(a) Time allowed

(i) Standard output per hour = 10 units

(ii) Time allowed per piece = $\frac{1}{\text{Standard output per hour}} \times \frac{1}{10}$ hours(iii) Time allowed = Output units $\times \frac{1}{10}$ hours(b) Basic wages = Hours worked \times Time rate(c) Bonus = $\frac{1}{2}$ Time saved \times Time rate

(c) Rowan Premium Bonus

Workers	Hours worked	Output units	Time allowed (hours)	Time saved (4 - 2)	Time rate (Rs.)	Basic wages (Rs.)	Bonus (Rs.)	Earnings for the day (7 + 8)	Effective rate per hour (Rs.)
Govind	8	80	8	0	4	32	0	32.00	4.00
Ram	8	100	10	2	4	32	6.40	38.40	4.80
Shyam	8	120	12	4	4	32	10.67	42.67	5.33

Note:

$$\text{Bonus} = \frac{\text{Time saved}}{\text{Time allowed}} \times \text{Basic wages}$$

Example 5.11

A skilled worker in XYZ Ltd. is paid a guaranteed wage rate of Rs. 30 per hour. The standard time per unit for a particular product is 4 hours. P, a machineman, has been paid wages under the Rowan Incentive Plan and he had earned an effective hourly rate of Rs. 37.50 on the manufacture of that particular product.

What could have been his total earnings and effective hourly rate, had he been put on Halsey Incentive Scheme (50%)? (CA, PE, Exam II, Group II, Nov. 1999)

Solution:

Let T hours be the total time worked in hours by the skilled worker (machineman P); Rs 30 is the rate per hour; standard time is 4 hours per unit and effective hourly earning rate is Rs. 37.50 then

$$\text{Earning} = \text{Hours worked} \times \text{Rate per hour} + \frac{\text{Time saved}}{\text{Time allowed}} \times \text{Time taken} \times \text{Rate per hour}$$

(Under Rowan incentive plan)

$$\text{Rs. } 37.5T = T \times \text{Rs. } 30 + \frac{(4 - T)}{4} \times T \times \text{Rs. } 30 = \text{Rs. } 105$$

$$\text{Rs. } 37.5 = \text{Rs. } 30 + (4 - T) \times \text{Rs. } 7.5$$

Or $\text{Rs. } 7.5 T = \text{Rs. } 22.5$

Or $T = 3$ hours

Total earnings and effective hourly rate of skilled worker (machineman P) under Halsey Incentive Scheme (50%)

$$\begin{aligned} \text{Total earnings} &= \text{Hours worked} \times \text{Rate per hour} + 1/2 \text{ Time saved} \times \text{Rate per hour} \\ &\quad \text{(Under 50\% Halsey Incentive Scheme)} \\ &= 3 \text{ hours} \times \text{Rs. } 30 + 1/2 \times 1 \text{ hour} \times \text{Rs. } 30 \end{aligned}$$

$$\text{Effective hourly rate} = \frac{\text{Total earnings}}{\text{Hours taken}} = \frac{\text{Rs. } 105}{3 \text{ hours}} = \text{Rs. } 35$$

Example 5.12

A company is undecided as to what kind of wage scheme should be introduced. The following particulars have been compiled in respect of three systems, which are under consideration of the management.

		Workers	
Actual hours worked in a week	38	40	34
Hourly rate of wages	Rs. 6	Rs. 5	Rs. 7.20
Production in units			
Production P	21	—	60
Product Q	36	—	135
Product R	46	25	—
Standard time allowed per unit of each product is:			
	P	Q	R
	12	18	30

Minutes

For the purpose of piece rate, each minute is valued at Re. 0.10

You are required to calculate the wages of each worker under:

- Guaranteed hourly rates basis.
- Piece work earnings basis, but guaranteed at 75% of basic pay (guaranteed hourly rate) if his earnings are less than 50% of basic pay.
- Premium bonus basis where the worker receives bonus based on Rowan scheme.

(CA, PE, Exam II, Group II, Nov. 2002)

Solution:**(i) Computation of wages of each worker under guaranteed hourly rate basis**

Workers	Actual hours worked in a week	Hourly rate of wages (Rs.)	Wages (Rs.)
(a)	(b)	(c)	(d) = (b) × (c)
A	38	6.00	228.00
B	40	5.00	200.00
C	34	7.20	244.80

(ii) Computation of wages of each worker under piece work earnings basis

Product per unit	Piece rate	Worker A		Worker B		Worker C	
		Units	Wages	Units	Wages	Units	Wages
(a)	(b)	(c)	Rs. (d) = (b) × (c)	(e)	Rs. (f) = (b) × (e)	(g)	Rs. (h) = (b) × (g)
P	1.20	21	25.20	—	—	60	72
Q	1.80	36	64.80	—	—	135	243
R	3.00	46	138.00	25	75	—	—

Since each worker has been guaranteed at 75% of basic pay, if his earnings are less than 50% of basic pay, therefore, workers A and C will be paid the wages as computed viz., Rs. 228 and Rs. 315 respectively. The computed wage of worker B is Rs. 75 which is less than 50% of basic pay viz., Rs. 100 therefore he would be paid 75% × Rs. 200 or Rs. 150.

Working Notes:**1. Piece rate/per unit**

Product	Standard time per unit in minute	Piece rate each minute (Rs.)	Piece rate per unit (Rs.)
(a)	(b)	(c)	(d) = (b) × (c)
P	12	0.10	1.20
Q	18	0.10	1.80
R	30	0.10	3.00

2. Time allowed to each worker

Worker A = 21 units × 12 minutes + 36 units × 18 minutes + 46 units × 30 minutes
= 2,280 minutes = 38 hours

Worker B = 25 units × 30 minutes = 750 minutes = 12.5 hours

Worker C = 60 units × 12 minutes + 135 units × 18 minutes
= 720 minutes + 2,430 minutes = 3,150 minutes = 52.50 hours

(ii) Computation of wages of each worker under Premium bonus basis (where each worker receives bonus based on Rowan Scheme).

Workers	Time allowed hours (Refer to W. Note 2)	Time taken hours	Time saved hours	Wage rate/hour (Rs.)	Earnings (Rs.)	Bonus (Rs.)	Total of earning & bonus (Rs.)
A	38.00	38.00	—	6.00	228.00	—	228.00
B	12.50	40.00	—	5.00	200.00	—	200.00
C	52.50	34.00	18.50	7.20	244.80	86.26	331.06

Example 5.13

The finishing shop of a company employs 60 direct workers. Each worker is paid Rs. 400 as wages per week of 40 hours. When necessary, overtime is worked upto a maximum of 15 hours per week per worker at time rate plus one-half as premium. The current output on an average is 6 units per man hour which may be regarded as standard output. If bonus scheme is introduced, it is expected that the output will increase to 8 units per man hour. The workers will, if necessary, continue to work overtime upto the specified limit although no premium on incentives will be paid.

The company is considering introduction of either Halsey Scheme or Rowan Scheme of Wage Incentive system. The budgeted weekly output is 19,200 units. The selling price is Rs. 11 per unit and the direct material cost is Rs. 8 per unit. The variable overheads amount to Re. 0.50 per direct labour hour and the fixed overhead is Rs. 9,000 per week.

Prepare a statement to show the effect on the company's weekly profit of the proposal to introduce (a) Halsey Scheme and (b) Rowan Scheme. (CA, PE, Exam II, Group II, May 2002)

Solution:

Working Notes:

- Total available hours per week (60 workers × 40 hours) 2,400
- Total standard hours required to produced 19,200 units (19,200 units/6 units per hour) 3,200
- Total labour hours required after the introduction of bonus scheme to produce 19,200 units (19,200 units/8 units per man hour) 2,400
- Time saved in hours (3,200 hours – 2,400 hours) 800
- Wage rate per hour (Rs.) (Rs. 400/40 hours) 10
- Bonus:

$$\begin{aligned} \text{(i) Halsey Scheme} &= \frac{1}{2} \times \text{Time saved} \times \text{Wage rate per hour} \\ &= \frac{1}{2} \times 800 \text{ hours} \times \text{Rs. } 10 = \text{Rs. } 4,000 \end{aligned}$$

$$\begin{aligned} \text{(ii) Rowan Scheme} &= \frac{\text{Time saved}}{\text{Time allowed}} \times \text{Time taken} \times \text{Wage rate per hour} \\ &= \frac{800 \text{ hours}}{3,200 \text{ hours}} \times 2,400 \text{ hours} \times \text{Rs. } 10 \\ &= \text{Rs. } 6,000 \end{aligned}$$

**Statement showing the effect on the Company's Weekly
present profit by the introduction of Halsey and Rowan schemes**

	<i>Present (Rs.)</i>	<i>Halsey (Rs.)</i>	<i>Rowan (Rs.)</i>
Sales revenue: (A) (19,200 units × Rs. 11)	2,11,200	2,11,200	2,11,200
Direct material cost (19,200 units × Rs. 8)	1,53,600	1,53,600	1,53,600
Direct wages (Refer to working notes 2 and 3)	32,000 (3,200 hrs. × Rs. 10)	24,000 (2,400 hrs. × Rs. 10)	24,000 (2,400 hrs. × Rs. 10)
Overtime premium (800 hrs. × Rs. 5)	4,000		
Bonus (Refer to working notes 6 (i) and (ii))	-	4,000	6,000
Variable overheads	1,600 (3,200 hrs. × 0.50 P)	1,200 (2,400 hrs. × 0.50 P)	1,200 (2,400 hrs. × 0.50 P)
Fixed overheads	9,000	9,000	9,000
Total cost: (B)	<u>2,00,200</u>	<u>1,91,800</u>	<u>1,93,800</u>
Profit: {(A) - (B)}	11,000	19,400	17,400

Example 5.14

ZED Limited employing 50 skilled workers is considering the introduction of incentive scheme-either Halsey scheme (with 50% bonus) or Rowan scheme of wage payment for increasing the labour productivity to cope up the increasing demand for the product by 40%. It is believed that proposed incentive scheme could bring about an average 20% increase over the present earnings of the workers; it could act as sufficient incentive for them to produce more.

Because of assurance, the increase in productivity has been observed as revealed by the figures for the month of April, 2004.

Hourly rate of wages (guaranteed)	Rs. 30
Average time for producing one unit by one worker at the previous Performance (This may be taken as time allowed)	1.975 hours
Number of working days in the month	24
Number of working hours per day of each worker	8
Actual production during the month	6,120 units

Required:

- (i) Calculate the effective rate of earnings under the Halsey scheme and the Rowan scheme.
- (ii) Calculate the savings to the ZED Limited in terms of direct labour cost per piece.
- (iii) Advise ZED Limited about the selection of the scheme to fulfill their assurance.

(CA, PE, Exam II, Group II, May 2004,