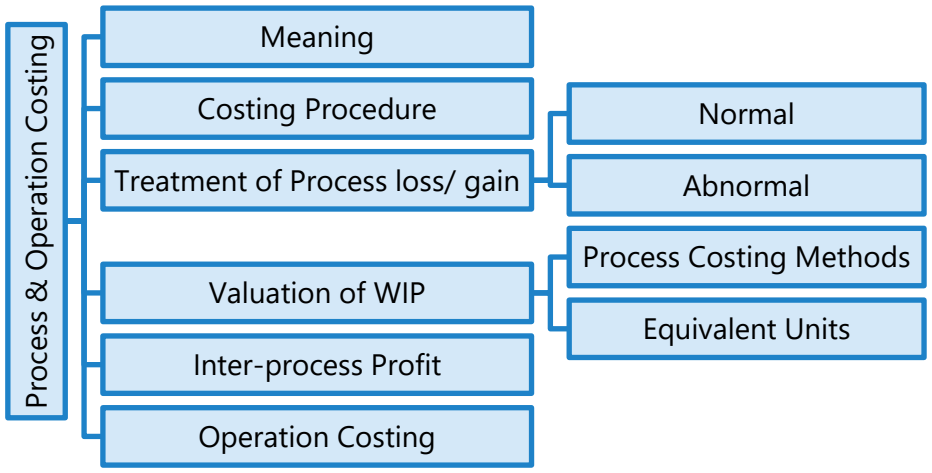
CHAPTER 10

PROCESS & OPERATION COSTING

LEARNING OUTCOMES

- State the meaning of Process and Operation Costing.
- Discuss the treatment of process loss and gains in cost accounts.
- Compute equivalent completed production units.
- Discuss the various methods of valuation of work in process.
- State the meaning and treatment of Inter-process profits.

CHAPTER OVERVIEW



1. MEANING OF PROCESS COSTING

Process Costing is a method of costing used in industries where the material has to pass through two or more processes for being converted into a final product. It is defined as "a method of Cost Accounting whereby costs are charged to processes or operations and averaged over units produced". A separate account for each process is opened and all expenditure pertaining to a process is charged to that process account. Such type of costing method is useful in the manufacturing of products like steel, paper, medicines, soaps, chemicals, rubber, vegetable oil, paints, varnish etc. where the production process is continuous and the output of one process becomes the input of the following process till completion.

This can be understood with the help of the following diagram:

1.1 Basic Features

Industries, where process costing can be applied, have normally one or more of the following features:

1. Each plant or factory is divided into a number of processes, cost centres or departments, and each such division is a stage of production or a process.
2. **Manufacturing activity is carried on continuously by means of one or more process run sequentially, selectively or simultaneously.**
3. **The output of one process becomes the input of another process.**
4. The end product usually is of like units not distinguishable from one another.
5. **It is not possible to trace the identity of any particular lot of output to any lot of input materials**. For example, in the sugar industry, it is impossible to trace any lot of sugar bags to a particular lot of sugarcane fed or *vice versa*.
6. Production of a product may give rise to Joint and/or By-Products.

2. COSTING PROCEDURE IN PROCESS COSTING

The Cost of each process comprises the cost of:

(*i*) Materials (*ii*) Employee Cost (Labour)

(*iii*) Direct expenses, and (*iv*) Overheads of production.

Materials - Materials and supplies which are required for each process are drawn against Material Requisitions Notes from the stores. **Each process for which the materials are used, are debited with the cost of materials consumed** on the basis of the information received from the Cost Accounting department. The finished product of first process generally become the raw materials of second process; under such a situation the account of second process is debited with the cost of transfer from the first process and also with the cost of any additional material used in process.

Employee Cost (Labour) - Each **process account should be debited with the labour cost** or wages paid to labour for carrying out the processing activities. Sometimes the wages paid are apportioned over the different processes after selecting appropriate basis.

Direct expenses - Each **process account should be debited with direct expenses** like depreciation, repairs, maintenance, insurance etc. associated with it.

Production Overheads- Expenses like rent, power expenses, lighting bills, gas and water bills etc. are known as production overheads. These expenses cannot be allocated to a process. The suitable way out to recover them is to apportion them over different processes by using suitable basis. Usually, these expenses are estimated in advance and **the processes debited with these expenses on a pre-determined basis.**

ILLUSTRATION 1

From the following data, PREPARE process accounts indicating the cost of each process and the total cost. The total units that pass through each process were 240 for the period.

	Process I (₹)	*Process II (₹)*	*Process III (₹)*
Materials	*1,50,000*	*50,000*	*20,000*
Labour	*80,000*	*2,00,000*	*60,000*
Other expenses	*26,000*	*72,000*	*25,000*

Indirect expenses amounting to ₹ 85,000 may be apportioned on the basis of wages. There was no opening or closing stock.

SOLUTION

Dr. **Process- I Account** *Cr.*

Particulars	Per unit (₹)	Total (₹)	Particulars	Per unit (₹)	Total (₹)
To Material	625	1,50,000	By Process -II A/c	1,150	2,76,000
" Labour	334	80,000	(Transfer to Process-II)		
" Other expenses	108	26,000			
" Indirect expenses*	83	20,000			
	1,150	2,76,000		1,150	2,76,000

Dr. **Process- II Account** *Cr.*

Particulars	Per unit (₹)	Total (₹)	Particulars	Per unit (₹)	Total (₹)
To Process-I A/c	1,150	2,76,000	By Process-III A/c	2,700	6,48,000
" Material	208	50,000	(Transfer to Process-III)		
" Labour	834	2,00,000			
" Other expenses	300	72,000			
" Indirect expenses*	208	50,000			
	2,700	6,48,000		2,700	6,48,000

Dr. **Process- III Account** *Cr.*

Particulars	Per unit (₹)	Total (₹)	Particulars	Per unit (₹)	Total (₹)
To Process-II A/c	2,700	6,48,000	By Finished Stock A/c (Transferred)	3,200	7,68,000
Material	83	20,000			
" Labour	250	60,000			
" Other expenses	104	25,000			
" Indirect expenses*	63	15,000			
	3,200	7,68,000		3,200	7,68,000

* Apportionment of Indirect expenses among Process-I, Process-II and Process-III

Total Wages to processes (I + II +III) = ₹ 80,000 + ₹ 2,00,000 + ₹ 60,000 = ₹ 3,40,000

Apportionment to:

Process- I = $\frac{₹85,000}{₹3,40,000} \times ₹80,000$ = ₹ 20,000;

Process- II = $\frac{₹85,000}{₹3,40,000} \times ₹2,00,000$ = ₹50,000 and

Process- III = $\frac{₹85,000}{₹3,40,000} \times ₹60,000$ = ₹15,000

3. TREATMENT OF NORMAL, ABNORMAL LOSS AND ABNORMAL GAIN

3.1 Normal and Abnormal Loss

Loss of material is inherent during processing operation. The loss of material under different processes arises due to reasons like evaporation or a change in the moisture content etc. Process loss is defined as the loss of material arising during the course of a processing operation and is equal to the difference between the input quantity of the material and its output.

There are two types of material losses viz. (i) Normal loss and (ii) Abnormal loss.

(i) Normal Process Loss: It is also known as normal wastage. It is defined as **the loss of material which is inherent in the nature** of work. Such a loss can be reasonably anticipated from the nature of the material, nature of operation, the experience and technical data. It is unavoidable because of nature of the material or the process. It also includes units withdrawn from the process for test or sampling.

Treatment in Cost Accounts: The cost of **normal process loss in practice is absorbed by good units produced** under the process. The amount realised by the sale of normal process loss units should be credited to the process account.

Example-1 (Normal loss with no realisable value)

A product passes through Process- I and Process- II. Materials issued to Process- I amounted to ₹ 40,000, Wages ₹ 30,000 and manufacturing overheads were ₹ 27,000. Normal loss anticipated was 5% of input. 4,750 units of output were produced and transferred-out from Process-I. There were no opening stocks. Input raw material issued to Process I were 5,000 units. Scrap has no realisable value.

You are required to PREPARE Process- I account, value of normal loss and units transferred to Process-II.

SOLUTION

Process- I Account

Particulars	Units	(₹)	Particulars	Units	(₹)
To Material	5,000	40,000	By Normal loss	250	0
To Wages	-	30,000			
To Overhead	-	27,000	By Process II	4,750	97,000
	5,000	97,000		5,000	97,000

Value of Normal loss = Scrap realisable value less cost to sale

Since, scraps do not realise any value, hence, value of normal loss is zero.

Value of units transferred to Process-II:

$$= \frac{\text{Total Cost - Realisable value of normal loss}}{\text{Total input units - Normal loss units}} \times \text{Units transferred}$$

$$= \frac{₹97,000 - 0}{5,000 \text{ units} - 250 \text{ units}} \times 4,750 \text{ units} = 97,000$$

Example-2 (Normal loss with realisable value)

A product passes through Process- I and Process- II. Materials issued to Process- I amounted to ₹ 40,000, Wages ₹ 30,000 and manufacturing overheads were ₹ 27,000. Normal loss anticipated was 5% of input. 4,750 units of output were produced and transferred-out from Process-I. There were no opening stocks. Input raw material issued to Process I were 5,000 units. Scrap has realisable value of ₹ 2 per unit.

You are required to PREPARE Process- I account, value of normal loss and units transferred to Process-II.

SOLUTION

Process- I Account

Particulars	Units	(₹)	Particulars	Units	(₹)
To Material	5,000	40,000	By Normal loss	250	500
To Wages	-	30,000			
To Overhead	-	27,000	By Process II	4,750	96,500
	5,000	97,000		5,000	97,000

Value of Normal loss = Scrap realisable value less cost to sale

= 250 units × ₹2 = ₹500

Value of units transferred to Process-II:

$$= \frac{\text{Total Cost} - \text{Realisable value of normal loss}}{\text{Total input units} - \text{Normal loss units}} \times \text{Units transferred}$$

$$= \frac{₹97,000 - ₹500}{5,000 \text{units} - 250 \text{units}} \times 4,750 \text{units} = 96,500$$

(ii) Abnormal Process Loss: It is also known as abnormal wastage. It is defined as the **loss in excess of the pre-determined loss** (Normal process loss). This type of loss may occur due to the carelessness of workers, a bad plant design or operation, sabotage etc. Such a loss cannot obviously be estimated in advance. But it can be kept under control by taking suitable measures.

Treatment in Cost Accounts: The cost of an abnormal process loss unit is equal to the cost of a good unit. The total cost of abnormal process loss is credited to the process account from which it arises. Cost of abnormal process loss is not treated as a part of the cost of the product. In fact, **the total cost of abnormal process loss is debited to costing profit and loss account.**

Example-3 (Abnormal loss with realisable value)

A product passes through Process- I and Process- II. Materials issued to Process- I amounted to ₹ 40,000, Wages ₹ 30,000 and manufacturing overheads were ₹ 27,000. Normal loss anticipated was 5% of input. 4,550 units of output were produced and transferred-out from Process-I. There were no opening stocks. Input raw material issued to Process I were 5,000 units. Scrap has realisable value of ₹ 2 per unit.

You are required to PREPARE Process- I account, value of normal loss, abnormal loss and units transferred to Process-II.

SOLUTION

Process- I Account

Particulars	Units	(₹)	Particulars	Units	(₹)
To Material	5,000	40,000	By Normal loss	250	500
To Wages	-	30,000	By Abnormal Loss	200	4,063
To Overhead	-	27,000	By Process II	4,550	92,437
	5,000	97,000		5,000	97,000

Value of Normal loss = Scrap realisable value less cost to sale

= 250 units × ₹2 = ₹500

Value of Abnormal loss:

$$= \frac{\text{Total Cost} - \text{Realisable value of normal loss}}{\text{Total input units} - \text{Normal loss units}} \times \text{Abnormal loss units}$$

$$= \frac{₹\,97,000 - ₹500}{5,000\text{units} - 250\text{units}} \times 200\text{units} = ₹4,063$$

Value of units transferred to Process-II:

$$= \frac{\text{Total Cost} - \text{Realisable value of normal loss}}{\text{Total input units} - \text{Normal loss units}} \times \text{Units transferred}$$

$$= \frac{₹97,000 - ₹500}{5,000\text{units} - 250\text{units}} \times 4,550\text{units} = ₹\,92,437$$

3.2 Abnormal Process Gain/ Yield

Sometimes, loss under a process is less than the anticipated normal figure. In other words, **the actual production exceeds the expected figures**. Under such a situation the difference between actual and expected loss or actual and expected production is known as abnormal gain or yield. So, abnormal gain may be defined as an unexpected gain in production under the normal conditions. This arises due to over- estimation of process loss, improvements in work efficiency of workers, use od better technology in production etc.

Treatment in Cost Accounts: The process account under which abnormal gain arises is debited with the abnormal gain and credited to abnormal gain account which will be closed by transferring to the Costing Profit and Loss account. The cost of abnormal gain is computed on the basis of normal production.

Example-4 (Abnormal gain/ yield with realisable value)

A product passes through Process- I and Process- II. Materials issued to Process- I amounted to ₹ 40,000, Wages ₹ 30,000 and manufacturing overheads were ₹ 27,000. Normal loss anticipated was 5% of input. 4,850 units of output were produced and transferred-out from Process-I. There were no opening stocks. Input raw material issued to Process I were 5,000 units. Scrap has realisable value of ₹ 2 per unit.

You are required to PREPARE Process- I account, value of normal loss, abnormal loss/ gain and units transferred to Process-II.

SOLUTION

Process- I Account

Particulars	Units	(₹)	Particulars	Units	(₹)
To Material	5,000	40,000	By Normal loss	250	500
To Wages	-	30,000			
To Overhead	-	27,000	By Process II	4,850	98,532
To Abnormal Gain A/c	100	2,032			
	5,100	99,032		5,100	99,032

Value of Normal loss = Scrap realisable value less cost to sale

= 250 units × ₹2 = ₹500

(even though the actual loss is less than the expected loss (Normal loss), value of the normal loss is calculated on the estimated figure)

Value of Abnormal Gain:

$$= \frac{\text{Total Cost} - \text{Realisable value of normal loss}}{\text{Total input units} - \text{Normal loss units}} \times \text{Abnormal Gain units}$$

$$= \frac{₹97,000 - ₹500}{5,000 \text{ units} - 250 \text{ units}} \times 100 \text{ units} = ₹2,032$$

Value of units transferred to Process-II:

$$= \frac{\text{Total Cost} - \text{Realisable value of normal loss}}{\text{Total input units} - \text{Normal loss units}} \times \text{Units transferred}$$

$$= \frac{₹97,000 - ₹500}{5,000 \text{units} - 250 \text{units}} \times 4,850 \text{units} = ₹\ 98,532$$

(Process A/c is debited with the value of abnormal gain as calculated above but the Costing Profit & Loss Account will only be credited with actual amount of abnormal gain only considering the actual realisable value through Abnormal Gain A/c, as shown below)

Abnormal Gain A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Normal Loss A/c (100 units × ₹2)	100	200	By Process-I A/c	100	2,032
To Costing P&L A/c	-	1,832			
	100	2,032		100	2,032

(The Costing P&L Account is credited only for actual gain amount)

ILLUSTRATION 2

A product passes through three processes. The output of each process is treated as the raw material of the next process to which it is transferred and output of the third process is transferred to finished stock.

	Process-I (₹)	*Process-II (₹)*	*Process-III (₹)*
Materials issued	*40,000*	*20,000*	*10,000*
Labour	*6,000*	*4,000*	*1,000*
Manufacturing overhead	*10,000*	*10,000*	*15,000*

10,000 units have been issued to the Process-I and after processing, the output of each process is as under:

Process	*Output*	*Normal Loss*
Process-I	*9,750 units*	*2%*
Process-II	*9,400 units*	*5%*
Process-III	*8,000 units*	*10%*

No stock of materials or of work-in-process was left at the end. CALCULATE the cost of the finished articles.

SOLUTION

Dr. **Process-I Account** *Cr.*

Particulars	Units	Total (₹)	Particulars	Units	Total (₹)
To Material	10,000	40,000	By Normal Loss A/c (2% of 10,000 units)	200	--

"	Labour	--	6,000	" Abnormal Loss A/c (₹ 5.7142 × 50 units)	50	286
"	Manufacturing OH	--	10,000	" Process-II A/c (₹ 5.7142 × 9,750 units)	9,750	55,714
		10,000	56,000		10,000	56,000

Cost per unit of completed units and abnormal loss:

$$\frac{\text{Total Cost}}{\text{Inputs} - \text{Normal loss}} = \frac{₹\,56,000}{10,000\,\text{units} - 200\,\text{units}} = ₹\ 5.7142$$

Dr. **Process-II Account** *Cr.*

	Particulars	Units	Total (₹)	Particulars	Units	Total (₹)
To	Process-I A/c	9,750	55,714	By Normal Loss A/c (5% of 9,750 units)	488	--
"	Material	--	20,000	" Process-III A/c (₹ 9.6862 × 9,400 units)	9,400	91,051
"	Labour	--	4,000			
"	Manufacturing OH	--	10,000			
"	Abnormal Gain A/c (₹ 9.6862 × 138 units)	138	1,337			
		9,888	91,051		9,888	91,051

Cost per unit of completed units and abnormal gain:

$$\frac{\text{Total Cost}}{\text{Inputs-Normal loss}} = \frac{₹89,714}{9,750\,\text{units} - 488\,\text{units}} = ₹\ 9.6862$$

Dr. **Process-III Account** *Cr.*

Particulars	Units	Total (₹)	Particulars	Units	Total (₹)
To Process-II A/c	9,400	91,051	By Normal Loss A/c (10% of 9,400 units)	940	--
" Material	--	10,000	" Abnormal Loss A/c (₹13.8358 × 460 units)	460	6,364
" Labour	--	1,000	" Finished Stock A/c (₹13.8358 × 8,000 units)	8,000	1,10,687
" Manufacturing OH	--	15,000			
	9,400	1,17,051		9,400	1,17,051

Cost per unit of completed units and abnormal loss:

$$\frac{\text{Total Cost}}{\text{Inputs}-\text{Normal loss}} = \frac{₹1,17,051}{9,400\text{units}-940\text{units}} = ₹13.8358$$

ILLUSTRATION 3

RST Limited processes Product Z through two distinct processes – Process- I and Process-II. On completion, it is transferred to finished stock. From the following information for the current year, PREPARE Process- I, Process- II and Finished Stock A/c:

Particulars	Process- I	Process- II
Raw materials used	*7,500 units*	--
Raw materials cost per unit	*₹ 60*	--
Transfer to next process/finished stock	*7,050 units*	*6,525 units*
Normal loss (on inputs)	*5%*	*10%*
Direct wages	*₹ 1,35,750*	*₹ 1,29,250*
Direct Expenses	*60% of Direct wages*	*65% of Direct wages*
Manufacturing overheads	*20% of Direct wages*	*15% of Direct wages*
Realisable value of scrap per unit	*₹ 12.50*	*₹ 37.50*

6,000 units of finished goods were sold at a profit of 15% on cost. Assume that there was no opening or closing stock of work-in-process.

SOLUTION

Process- I A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Raw material used (₹60 × 7,500 units)	7,500	4,50,000	By Normal loss (5% of 7,500 units) × ₹12.5	375	4,688
To Direct wages	--	1,35,750	By Process- II A/c (₹96.7947 × 7,050 units)	7,050	6,82,403
To Direct expenses	--	81,450	By Abnormal loss (₹96. 7947 × 75 units)	75	7,259
To Manufacturing overhead		27,150			
	7,500	6,94,350		7,500	6,94,350

Cost per unit of completed units and abnormal loss:

$$\frac{\text{Total Cost} - \text{Realisable value from normal loss}}{\text{Inputs units} - \text{Normal loss units}}$$

$$= \frac{₹6,94,350 - ₹4,688}{7,500 \text{units} - 375 \text{units}} = \frac{₹6,89,662}{7,125 \text{units}} = ₹\ 96.7947$$

Process- II A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Process- I A/c	7,050	6,82,403	By Normal loss (10% of 7,050 units) × ₹ 37.5	705	26,438
To Direct wages	--	1,29,250	By Finished Stock A/c (₹ 140.0496 × 6,525 units)	6,525	9,13,824
To Direct expenses	--	84,013			
To Manufacturing overhead	--	19,387			
To Abnormal gain (₹ 140.0496 × 180 units)	180	25,209			
	7,230	9,40,262		7,230	9,40,262

Cost per unit of completed units and abnormal loss:

$$\frac{\text{Total Cost - Realisable value from normal loss}}{\text{Inputs units - Normal loss units}}$$

$$= \frac{₹9,15,053 - ₹26,438}{7,050 \text{ units} - 705 \text{ units}} \quad = \frac{₹8,88,615}{6,345 \text{ units}} \quad = ₹140.0496$$

Finished Goods Stock A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Process II A/c	6,525	9,13,824	By Cost of Sales (₹140.0496 × 6,000 units)	6,000	8,40,298
			By Balance c/d	525	73,526
	6,525	9,13,824		6,525	9,13,824

Income Statement

Particulars	(₹)	Particulars	(₹)
To Cost of sales (₹140.0496 × 6,000 units)	8,40,298	By Abnormal gain {180 units × (₹140.0496 – ₹37.50)}	18,459
To Abnormal loss {75 units × (₹96.7947 – ₹12.50)}	6,322	By Sales (₹8,40,298 × 115%)	9,66,343
To Net Profit	1,38,182		
	9,84,802		9,84,802

4. VALUATION OF WORK-IN-PROCESS

In the case of process type of industries, it is possible to determine the average cost per unit by dividing the total cost incurred during a given period of time by the total number of units produced during the same period. But this is hardly the case in most of the process type industries where manufacturing is a continuous activity. The reason is that the cost incurred in such industries represents the cost of work carried on opening work-in-process, closing work-in-process and completed units. Thus to ascertain the cost of each completed unit, it is necessary

to ascertain the cost of work-in-process in the beginning and at the end of the process.

The valuation of work-in-process presents a good deal of difficulty because it has units under different stages of completion from those in which work has just begun to those which are only a step short of completion. Work-in-process can be valued on actual basis, *i.e.,* materials used on the unfinished units and the actual amount of labour expenses involved. However, the degree of accuracy in such a case cannot be satisfactory. An alternative method is based on converting partly finished units into equivalent finished units.

4.1 Equivalent Units

Equivalent units or equivalent production units, means converting the incomplete production units into their equivalent completed units. Under each process, an estimate is made of the percentage completion of work-in-process with regard to different elements of costs, *viz.,* material, labour and overheads. It is important that the estimate of percentage of completion should be as accurate as possible. The formula for computing equivalent completed units is:

$$\text{Equivalent completed units} = \left(\begin{array}{c}\text{Actual number of units in}\\ \text{the process of manufacture}\end{array}\right) \times \left(\begin{array}{c}\text{Percentage of}\\ \text{Work completed}\end{array}\right)$$

For instance, if 25% of work has been done on the average of units still under process, then 200 such units will be equal to 50 completed units and the cost of work-in-process will be equal to the cost of 50 finished units.

The following table may be used to compute the equivalent units:

Input Details	Units	Output Particulars	Units	Equivalent Units					
				Material		Labour		Overhead	
				%	Units	%	Units	%	Units
			a	b	c= a×b	d	e=a×d	f	g=a×f
Opening W-I-P	xxx	Opening W-I-P*	xxx	xxx	xxx	xxx	xxx	xxx	xxx
Unit Introduced	xxx	Finished output**	xxx	xxx	xxx	xxx	xxx	xxx	xxx
		Normal loss***	xxx	-	-	-	-	-	-
		Abnormal loss/Gain****	xxx	xxx	xxx	xxx	xxx	xxx	xxx
		Closing W-I-P	xxx	xxx	xxx	xxx	xxx	xxx	xxx
Total	xxx	Total	xxx		xxx		xxx		xxx

* Equivalent units for Opening W-I-P is calculated only under FIFO method. Under the Average method, it is not shown separately.

**Under the FIFO method, Finished Output = Units completed and transferred to next process *less* Opening WIP. Under Average method, Finished Output = Units completed and transferred.

***For normal loss, no equivalent unit is calculated.

****Abnormal Gain/ Yield is treated as 100% complete in respect of all cost elements irrespective of percentage of completion.

5. STEPS IN PROCESS COSTING

For each production process, a Production Cost Report is prepared at the end of each accounting period. The objective of preparing the report is to know physical units and equivalent units in process, element wise cost of goods produced and transferred, goods in process (work-in-process), units lost due to abnormal reasons i.e. abnormal loss etc. To prepare the report, the following steps are generally followed:

Step-1: Analysis of physical flow of production units

The first step is to determine and analyse the number of physical units in the form of inputs (introduced fresh or transferred from previous process, beginning work-in-process) and outputs (completed and work-in-process).

Step-2: Calculation of equivalent units for each cost elements

The second step is to calculate equivalent units of production for each cost element i.e. for material, labour and overheads. It is calculated by taking the extent of work done in respect of each element. For example, if there are 1,000 units in work-in-process at the end of the month. All materials are introduced at the beginning of production process. For labour and overheads, 20% more work is required to get it completed. In this example, the equivalent units of work-in-process in respect of material would be 1,000 units (1,000 units × 100% complete) and for labour and overheads 800 units (1,000 units × 80% complete).

Step-3: Determination of total cost for each cost element

Total cost for each cost element is collected and accumulated for the period. The process of cost collection has already been discussed above.

Step-4: Computation of cost per equivalent unit for each cost element

In this step, the cost per equivalent unit for each cost element is calculated. The total cost as calculated in Step-3 is divided by the equivalent units as determined in Step-2.

Step-5: Assignment of total costs to units completed and ending WIP

In this step, the total cost for units completed, units transferred to next process, ending work in process, abnormal loss etc. are calculated and posted in the process account and production cost report.

6. PROCESS COSTING METHODS

Mainly two methods for valuation of work-in-process are followed:

(i) First-in-First Out (FIFO) method.

(ii) Weighted Average(Average) method

(i) First-in-first-out (FIFO) method

Under this method the units completed and transferred are taken from both opening work-in-process (WIP) and freshly introduced materials/inputs. **The cost to complete the opening WIP and other completed units are calculated separately.** The cost of opening WIP is added to cost incurred on completing the incomplete (WIP) units into complete one. The total cost of units completed and transferred is calculated by adding opening WIP cost to cost on freshly introduced inputs. **In this method the closing stock of work in process is valued at current cost**.

ILLUSTRATION 4

Opening work-in-process 1,000 units (60% complete); Cost ₹ 1,10,000. Units introduced during the period 10,000 units; Cost ₹ 19,30,000. Transferred to next process - 9,000 units.

Closing work-in-process - 800 units (75% complete). Normal loss is estimated at 10% of total input including units in process at the beginning. Scraps realise ₹ 10 per unit. Scraps are 100% complete.

Using FIFO method, COMPUTE equivalent production and cost per equivalent unit. Also evaluate the output.

SOLUTION

Statement of Equivalent Production Units (Under FIFO Method)

Particulars	Input units	Particulars	Output units	Equivalent Production	
				(%)	Equivalent units
Opening W-I-P	1,000	From opening W-I-P	1,000	40	400
Units introduced	10,000	From fresh inputs	8,000	100	8,000
		Units completed (Transferred to next process)	9,000		
		Normal Loss {10% (1,000 + 10,000 units)}	1,100	--	--
		Closing W-I-P	800	75	600
		Abnormal loss (Balancing figure)	100	100	100
	11,000		11,000		9,100

Computation of cost per equivalent production unit:

Cost of the Process (for the period)	₹19,30,000
Less: Scrap value of normal loss (₹ 10 × 1,100 units)	(₹11,000)
Total process cost	₹ 19,19,000

$$\text{Cost per equivalent unit} = \frac{₹19,19,000}{9,100 \text{units}} = ₹\ 210.88$$

Statement of Evaluation

Particulars	Equivalent Units (EU)	Cost per EU (₹)	Amount (₹)
(i) Opening W-I-P completed during the period	400	210.88	84,352

Add: Cost of W-I-P at beginning	--	--	1,10,000
Complete cost of 1,000 units of opening W-I-P	1,000	194.35	1,94,352
(ii) Completely processed units	8,000	210.88	16,87,040
(iii) Abnormal Loss	100	210.88	21,088
(iv) Closing W-I-P	600	210.88	1,26,528

(The difference in total amount may arise due to rounding off error)

Process Explained:

(i) Total Units completed and Transferred is 9,000 units. Out of these 9,000 units, 1,000 units has been taken from opening WIP and the rest is from the fresh units introduced.

(ii) The opening WIP is 60% complete in respect of costs, hence, 40% more work is to be done during the period.

(iii) Total cost for cost elements for the period (current period only) is accumulated.

(iv) The realisable value of scrap (i.e. normal loss) is deducted from the total cost as accumulated above.

(v) Total cost less realisable value is divided by equivalent units to get cost per equivalent unit.

(vi) The equivalent cost as calculated above is multiplied by the equivalent units of completely processed goods, abnormal loss and closing WIP to get the value.

(vii) Cost of units completed and transferred is calculated separately for Opening WIP and fresh inputs.

(ii) Weighted Average (Average) Method:

Under this method, **the cost of opening work-in-process and cost of the current period are aggregated and the aggregate cost is divided by output in terms of completed units.** The equivalent production in this case consists of work-load already contained in opening work-in-process and work-load of current period.

The main difference between FIFO method and average method is that units of opening work in process and their cost are taken in full under average method while under FIFO method only the remaining work done now is considered.

ILLUSTRATION 5

Refer to information provided in Illustration 4 above and solve this by Weighted Average Method:

SOLUTION

Statement of Equivalent Units (Under Weighted Average Method)

Particulars	Input units	Particulars	Output units	Equivalent Production	
				(%)	Equivalent units
Opening W-I-P	1,000	Units completed (Transferred to next process)	9,000	100	9,000
Units introduced	10,000	Normal Loss {10% (1,000 + 10,000 units)}	1,100	--	--
		Closing W-I-P	800	75	600
		Abnormal loss (Balancing figure)	100	100	100
	11,000		11,000		9,700

Computation of cost per equivalent production unit :

Cost of Opening W-I-P	₹ 1,10,000
Cost of the Process (for the period)	₹19,30,000
Less: Scrap value of normal loss (₹ 10 × 1,100 units)	(₹11,000)
Total process cost	₹20,29,000

$$\text{Cost per equivalent unit} = \frac{₹20,29,000}{9,700 \text{units}} = ₹\ 209.18$$

Statement of Evaluation

Particulars		Equivalent Units (EU)	Cost per EU (₹)	Amount (₹)
(i)	Units Completed and transferred to next process	9,000	209.18	18,82,620
(ii)	Abnormal Loss	100	209.18	20,918
(iii)	Closing W-I-P	600	209.18	1,25,508

(The difference in total amount may arise due to rounding off error)

Process Explained:

(i) Total Units completed and Transferred is 9,000 units. All the 9,000 units has been considered as equally complete in respected of cost.

(ii) Total cost for cost elements for the period and opening WIP is accumulated.

(iii) The realisable value of scrap (i.e. normal loss) is deducted from the total cost as accumulated above.

(iv) Total cost less realisable value is divided by equivalent units to get cost per equivalent unit.

(v) The equivalent cost as calculated above is multiplied by the equivalent units of completely processed goods, abnormal loss and closing WIP to get the value.

7. INTER-PROCESS PROFITS

To control cost and to measure performance, different processes within an organization are designated as separate profit centres. In this type of organizational structure, the output of one process is transferred to the next process not at cost but at market value or cost plus a percentage of profit. *The difference between cost and the transfer price is known as inter-process profits.*

The advantages and disadvantages of using inter-process profit, in the case of process type industries are as follows:

Advantages:

1. Comparison between the cost of output and its market price at the stage of completion is facilitated.

2. Each process is made to stand by itself as to the profitability.

Disadvantages:

1. The use of inter-process profits involves complication.

2. The system shows profits which are not realised because of stock not sold out.

ILLUSTRATION 6

A Ltd. produces product 'AXE' which passes through two processes before it is completed and transferred to finished stock. The following data relate for the month of October:

	Process- I (₹)	***Process- II (₹)***	***Finished Stock (₹)***
Opening stock	*7,500*	*9,000*	*22,500*
Direct materials	*15,000*	*15,750*	*--*
Direct wages	*11,200*	*11,250*	*--*
Factory overheads	*10,500*	*4,500*	*--*
Closing stock	*3,700*	*4,500*	*11,250*
Inter-process profit included in opening stock	*--*	*1,500*	*8,250*

Output of Process- I is transferred to Process- II at 25% profit on the transfer price.

Output of Process- II is transferred to finished stock at 20% profit on the transfer price. Stock in processes is valued at prime cost. Finished stock is valued at the price at which it is received from process II. Sales during the period are ₹ 1,40,000.

PREPARE Process cost accounts and finished goods account showing the profit element at each stage.

SOLUTION

Process- I Account

Particulars	**Total (₹)**	**Cost (₹)**	**Profit (₹)**	**Particulars**	**Total (₹)**	**Cost (₹)**	**Profit (₹)**
Opening stock	7,500	7,500	--	Process- II A/c*	54,000	40,500	13,500
Direct materials	15,000	15,000	--	Closing Stock	3,700	3,700	--

Direct wages	11,200	11,200	--				
Prime Cost	33,700	33,700					
Overheads	10,500	10,500	--				
Total Cost	44,200	44,200					
Profit**	13,500	--	13,500				
	57,700	44,200	13,500		57,700	44,200	13,500

*Transfer price $= \frac{\text{Total cost - Closing stock}}{75\%} = \frac{44,200 - 3,700}{75\%} =$ ₹54,000

**Profit on transfer = 54,000 × 25% = ₹13,500

Process- II Account

Particulars	Total (₹)	Cost (₹)	Profit (₹)	Particulars	Total (₹)	Cost (₹)	Profit (₹)
Opening stock	9,000	7,500	1,500	Finished Stock A/c**	1,12,500	75,750	36,750
Transferred from Process- I	54,000	40,500	13,500	Closing stock*	4,500	3,750	750
Direct materials	15,750	15,750	--				
Direct wages	11,250	11,250	--				
Prime cost	90,000	75,000	15,000				
Overheads	4,500	4,500	--				
Total cost	94,500	79,500	15,000				
Profit***	22,500	--	22,500				
	1,17,000	79,500	37,500		1,17,000	79,500	37,500

* Cost of Closing Stock $= \frac{₹75,000}{₹90,000} \times ₹4,500 =$ ₹3,750

**Transfer price $= \frac{\text{Total cost - Closing stock}}{80\%} = \frac{94,500 - 4,500}{80\%} =$ ₹1,12,500

***Profit on transfer = 1,12,500 × 20% = ₹22,500

Finished Stock Account

Particulars	Total (₹)	Cost (₹)	Profit (₹)	Particulars	Total (₹)	Cost (₹)	Profit (₹)
Opening stock	22,500	14,250	8,250	Costing P&L A/c	1,40,000	82,425	57,575
Process- II	1,12,500	75,750	36,750	Closing stock*	11,250	7,575	3,675
Profit	16,250	--	16,250				
	1,51,250	90,000	61,250		1,51,250	90,000	61,250

$$* \text{ Cost of Closing Stock} = \frac{\text{Cost of transfer from Process - II}}{\text{Transfer price from Process - II}} \times \text{Value of closing stock}$$

(As per instruction given in the question)

$$= \frac{₹\ 75,750}{₹1,12,500} \times ₹\ 11,250 = ₹\ 7,575$$

8. OPERATION COSTING

This product costing system is used when an entity produces more than one variant of final product using different materials but with similar conversion activities. Which means conversion activities are similar for all the product variants but materials differ significantly. Operation Costing method is also known as Hybrid product costing system as materials costs are accumulated by job order or batch wise but conversion costs i.e. labour and overheads costs are accumulated by department, and process costing methods are used to assign these costs to products. Moreover, under operation costing, conversion costs are applied to products using a predetermined application rate. This predetermined rate is based on budgeted conversion costs.

For example, a company is manufacturing two grades of products, Product- Deluxe and Product- Regular. Both the products pass through a similar production process but require different quality and quantities of raw materials. The cost of raw material is accumulated on the basis of job or batches or units of two variants of products. But the costs for the conversion activities need not to be identified with the product variants as both the Products requires similar activities for conversion. Hence, conversion activity costs are accumulated on the basis of departments or processes only. Example of industries are ready made garments, Shoe making, jewelry etc.

SUMMARY

- **Process Costing:** Used in industries where the material has to pass through two or more processes for being converted into a final product.
- **Operation Costing**: It is the refinement of process costing. It is concerned with the determination of the cost of each operation rather than the process.
- **Treatment of Losses in process costing: -**

  (i) **Normal process loss -** The cost of normal process loss is absorbed by good units produced under the process. The amount realised by the sale of normal process loss units should be credited to the process account.

  (ii) **Abnormal process loss -** The total cost of abnormal process loss is credited to the process account from which it arises. The total cost of abnormal process loss is debited to costing profit and loss account.
- **Abnormal gain -** The process account under which abnormal gain arises is debited with the abnormal gain and credited to Abnormal gain account which will be closed by transferring to the Costing Profit and loss account.
- **Equivalent production units:** This concept is used in the industries where manufacturing is a continuous activity. Converting partly finished units into equivalent finished units.

  Equivalent production means converting the incomplete production units into their equivalent completed units.

  Equivalent completed units ={Actual number of units in the process of manufacture} × {Percentage of work completed}
- **Valuation of work-in-process: two main methods:**

  (1) First-in-First Out (FIFO) method.

  (2) Average Cost method (or weighted average cost method).
- **Inter-Process Profits**

  The output of one process is transferred to the next process not at cost but at market value or cost plus a percentage of profit. The difference between cost and the transfer price is known as inter-process profits.

TEST YOUR KNOWLEDGE

Multiple Choice Questions (MCQs)

1. *The type of process loss that should not be allowed to affect the cost of good units is:*

   (a) Abnormal loss

   (b) Normal loss

   (c) Seasonal loss

   (d) Standard loss

2. *200 units were introduced in a process in which 20 units is the normal loss. If the actual output is 150 units, then there is:*

   (a) No abnormal loss

   (b) No abnormal gain

   (c) Abnormal loss of 30 units

   (d) Abnormal gain of 30 units

3. *100 units are processed at a total cost of ₹ 160, normal loss is 10%, & scrap units are sold @ ₹ 0.25 each. If the output is 80 units, then the value of abnormal loss is:*

   (a) ₹ 2.50

   (b) ₹ 16

   (c) ₹ 17.50

   (d) ₹ 17.75

4. *When average method is used in process costing, the opening inventory costs are:*

   (a) Subtracted from the new costs

   (b) Added to the new costs

   (c) Kept separate from the costs of the new period

   (d) Averaged with other costs to arrive at total cost

5. *Spoilage that occurs under inefficient operating conditions and is ordinarily controllable is called:*

   (a) Normal spoilage

   (b) Abnormal spoilage

   (c) Normal defectives

   (d) None of the above

6. *The cost of normal process loss is -*

   (a) Absorbed by good units produced and amount realised by the sale of loss units should be debited to the process account.

   (b) Debited to costing profit and loss account.

   (c) Absorbed by good units produced.

   (d) Debited to costing profit and loss account and amount realised by the sale of loss units should be credited to the process account.

7. *The value of abnormal loss is equal to:*

   (a) Total cost of materials

   (b) Total process cost less realizable value of normal loss

   (c) Total process cost less cost of scrap

   (d) Total process cost less realizable value of normal loss less value of transferred out goods.

8. *Inter-process profit is calculated, because:*

   (a) a process is a cost centres

   (b) each process has to report profit

   (c) the efficiency of the process is measured

   (d) the wages of employees are linked to the process profitability.

9. *Under Weighted Average (Average) Method:*

   (a) The cost to complete the opening WIP is ignored.

(b) *The cost to complete the opening WIP and other completed units are calculated separately.*

(c) *The cost of opening work-in-process and cost of the current period are aggregated and the aggregate cost is divided by output in terms of completed units.*

(d) *Closing stock of work in process is valued at current cost.*

10. *A process account is debited by abnormal gain, the value is determined as:*

(a) *Equal to the value of normal loss*

(b) *Cost of good units less realizable value of normal loss*

(c) *Cost of good units less realizable value of actual loss*

(d) *Equal to the value of good units less closing stock*

11. *Lean Labs develops 55mm film using a four-step process that moves progressively through four departments. The company specializes in overnight service and has the largest drug store chain as its primary customer. Currently, direct labor, direct materials, and overhead are accumulated by departments.*

The cost accumulation system that best describes the system Lean Labs is using is:

(a) *Operation costing.*

(b) *Activity-based costing.*

(c) *Job-order costing.*

(d) *Process costing.*

12. *When compared with normal spoilage, abnormal spoilage:*

(a) *Arises more frequently from factors that are inherent in the manufacturing process.*

(b) *Is given the same accounting treatment as normal spoilage.*

(c) *Is generally thought to be more controllable by purchase department than production department.*

(d) *Is not typically influenced by the "tightness" of production standards.*

13. *Assume 550 units were worked on during a period in which a total of 500 good units were completed. Normal spoilage consisted of 30 units; abnormal spoilage, 20 units. Total production costs were ₹2,200. The company accounts for abnormal spoilage separately on the income statement as loss due to abnormal spoilage. Normal spoilage is not accounted for separately. What is the cost of the good units produced?*

    (a) ₹2,080

    (b) ₹2,115

    (c) ₹2,200

    (d) ₹2,332

14. *IC Limited uses process costing systems and inspects its goods post manufacturing. An engineer noticed on May 31st the following:*

Good units completed	*15,000*
Normal spoilage (units)	*300*
Abnormal spoilage (units)	*100*

Unit costs were: Material ₹ 2.50 and conversion costs (Labour & overheads) ₹6.00. The number of units that company would transfer to its finished goods stock and the related cost of these units are:

(a) 15,000 units transferred at a cost of ₹ 127,500

(b) 15,000 units transferred at a cost of ₹ 130,050

(c) 15,000 units transferred at a cost of ₹ 135,000

(d) 15,300 units transferred at a cost of ₹ 130,050

Theoretical Questions

1. *EXPLAIN briefly the procedure for the valuation of Work-in-Process.*
2. *EXPLAIN equivalent units.*
3. *"Operation costing is defined as refinement of Process costing." EXPLAIN it.*
4. *What is inter-process profit? STATE its advantages and disadvantages.*

Practical Problems

1. *An English willow company who manufactures cricket bat buys wood as its direct material. The Forming department processes the cricket bats and the cricket bats are then transferred to the Finishing department where stickers are applied. The Forming department began manufacturing 10,000 initial bats during the month of December for the first time and their cost is as follows:*

   Direct material: ₹ *33,000*

   Conversion costs: ₹ *17,000*

   Total ₹ *50,000*

   A total of 8,000 cricket bats were completed and transferred to the Finishing department, the rest 2,000 were still in the Forming process at the end of the month. All of the forming departments direct material were placed, but, on average, only 25% of the conversion costs was applied to the ending work in progress inventory.

   CALCULATE:

   (i) Equivalent units of production for each cost.

   (ii) The Conversion cost per Equivalent units.

   (iii) Cost of closing work in process (WIP) and finished products.

2. *Hill manufacturing Ltd uses process costing to manufacture Water density sensors for hydro sector. The following information pertains to operations for the month of May.*

Particulars	***Units***
Beginning WIP, May 1	*16,000*
Started in production during May	*1,00,000*
Completed production during May	*92,000*
Ending work in progress, May 31	*24,000*

   The beginning work in progress was 60% complete for materials and 20% complete for conversion costs. The ending inventory was 90% complete for material and 40% complete for conversion costs.

Costs pertaining to the month of May are as follows:

Beginning inventory costs are material ₹27,670, direct labour ₹30,120 and factory overhead ₹ 12,720.

Cost incurred during May are material used, ₹ 4,79,000, direct labour ₹1,82,880, factory overheads ₹ 3,91,160.

CALCULATE:

(i) Using the FIFO method, the equivalent units of production for material.

(ii) Cost per equivalent unit for conversion cost.

3. *Following information is available regarding Process-I for the month of February:*

Production Record:	
Units in process as on 1st February (All materials used, 25% complete for labour and overhead)	*4,000*
New units introduced	*16,000*
Units completed	*14,000*
Units in process as on 28th February (All materials used, 33-1/3% complete for labour and overhead)	*6,000*
Cost Records:	
Work-in-process as on 1st February	*(₹)*
Materials	*6,000*
Labour	*1,000*
Overhead	*1,000*
	8,000
Cost during the month:	
Materials	*25,600*
Labour	*15,000*
Overhead	*15,000*
	55,600

Presuming that average method of inventory is used, PREPARE:

(i) Statement of equivalent production.

(ii) Statement showing cost for each element.

(iii) Statement of apportionment of cost.

(iv) Process cost account for Process-I.

4. *Following details are related to the work done in Process-I by XYZ Company during the month of March:*

	(₹)
Opening work-in process (2,000 units)	
Materials	*80,000*
Labour	*15,000*
Overheads	*45,000*
Materials introduced in Process-I (38,000 units)	*14,80,000*
Direct Labour	*3,59,000*
Overheads	*10,77,000*

Units scrapped: 3,000 units

Degree of completion:

Materials *100%*

Labour and overheads *80%*

Closing work-in process: 2,000 units

Degree of completion:

Materials *100%*

Labour and overheads *80%*

Units finished and transferred to Process-II: 35,000 units

Normal Loss:

5% of total input including opening work-in-process.

Scrapped units fetch ₹ 20 per piece.

You are required to PREPARE using average method:

(i) Statement of equivalent production

(ii) Statement of cost

(iii) Statement of distribution cost, and

(iv) Process-I Account, Normal Loss Account and Abnormal Loss Account.

5. *A company produces a component, which passes through two processes. During the month of April, materials for 40,000 components were put into Process I of which 30,000 were completed and transferred to Process II. Those not transferred to Process II were 100% complete as to materials cost and 50% complete as to labour and overheads cost. The Process I costs incurred were as follows:*

Direct material	*₹15,000*
Direct wages	*₹18,000*
Factory overheads	*₹12,000*

Of those transferred to Process II, 28,000 units were completed and transferred to finished goods stores. There was a normal loss with no salvage value of 200 units in Process II. There were 1,800 units, remained unfinished in the process with 100% complete as to materials and 25% complete as regard to wages and overheads.

No further process material costs occur after introduction at the first process until the end of the second process, when protective packing is applied to the completed components. The process and packing costs incurred at the end of the Process II were:

Packing materials	*₹4,000*
Direct wages	*₹3,500*
Factory overheads	*₹4,500*

Required:

(i) PREPARE Statement of Equivalent Production, Cost per unit and Process I A/c.

(ii) PREPARE Statement of Equivalent Production, Cost per unit and Process II A/c.

6. *'Healthy Sweets' is engaged in the manufacturing of jaggery. Its process involve sugarcane crushing for juice extraction, then filtration and boiling of juice along with some chemicals and then letting it cool to cut solidified jaggery blocks.*

The main process of juice extraction (Process – I) is done in conventional crusher, which is then filtered and boiled (Process – II) in iron pots. The solidified jaggery blocks are then cut, packed and dispatched. For manufacturing 10 kg of jaggery, 100 kg of sugarcane is required, which extracts only 45 litre of juice.

Following information regarding Process – I has been obtained from the manufacturing department of Healthy Sweets for the month of January:

	(₹)
Opening work-in process (4,500 litre)	
Sugarcane	*50,000*
Labour	*15,000*
Overheads	*45,000*
Sugarcane introduced for juice extraction (1,00,000 kg)	*5,00,000*
Direct Labour	*2,00,000*
Overheads	*6,00,000*
Abnormal Loss: 1,000 kg	
Degree of completion:	
Sugarcane	*100%*
Labour and overheads	*80%*
Closing work-in process: 9,000 litre	

Degree of completion:	
Sugarcane	*100%*
Labour and overheads	*80%*

Extracted juice transferred for filtering and boiling: 39,500 litre

(Consider mass of 1 litre of juice equivalent to 1 kg)

You are required to PREPARE using average method:

(i) Statement of equivalent production,

(ii) Statement of cost,

(iii) Statement of distribution cost, and

(iv) Process-I Account.

Case Scenarios

1. *Arnav Ltd. manufactures chemical solutions used in paint and adhesive products. Chemical solutions are produced in different processes. Some of the processes are hazardous in nature which may results in fire accidents.*

   At the end of the last month, one fire accident occurred in the factory. The fire destroyed some of the paper files containing records of the process operations for the month.

   You being an associate to the Chief Manager (Finance), are assigned to prepare the process accounts for the month during which the fire occurred. From the documents and files of other sources, following information could be retrieved:

   Opening work-in-process at the beginning of the month was 500 litres, 80% complete for labour and 60% complete for overheads. Opening work-in-process was valued at ₹2,78,000.

   Closing work-in-process at the end of the month was 100 litres, 20% complete for labour and 10% complete for overheads.

   Normal loss is 10% of input (fresh) and total losses during the month were 800 litres partly due to the fire damage.

   Output transferred to finished goods was 3,400 litres.

   Losses have a scrap value of ₹20 per litre.

All raw materials are added at the commencement of the process.

The cost per equivalent unit is ₹660 for the month made up as follows:

Raw Material ₹300 Labour ₹200 Overheads ₹160

The company uses FIFO method to value work-in-process and finished goods.

The following information are required for managerial decisions:

i. How much quantity of raw material introduced during the month?

(a) *4,300 Litres*

(b) *3,500 Litres*

(c) *4,200 Litres*

(d) *3,800 Litres*

ii. The Quantity of normal loss and abnormal loss are:

(a) *Normal loss- 380 litres & Abnormal loss- 420 litres*

(b) *Normal loss- 350 litres & Abnormal loss – 450 litres*

(c) *Normal loss- 430 litres & Abnormal loss – 370 litres*

(d) *Normal loss- 420 litres & Abnormal loss – 380 litres.*

iii. Value of raw material added to the process during the month is:

(a) *₹10,10,000*

(b) *₹10,33,600*

(c) *₹10,18,400*

(d) *₹10,20,000*

iv. Value of labour and overhead in closing Work-in-process are:

(a) *₹4,000 & ₹1,600 respectively*

(b) *₹20,000 & ₹16,000 respectively*

(c) *₹16,000 & ₹9,000 respectively*

(d) *₹13,200 & ₹6,600 respectively*

v. Value of output transferred to finished goods is:

(a) *₹22,57,200*

(b) *₹20,06,400*

(c) *₹22,44,000*

(d) *₹19,27,200*

ANSWERS/ SOLUTIONS

Answers to the MCQs

1.	(a)	**2.**	(c)	**3.**	(c)	**4.**	(b)	**5.**	(b)	**6.**	(c)
7.	(d)	**8.**	(c)	**9.**	(c)	**10.**	(b)	**11.**	(d)	**12.**	(d)
13.	(b)	**14.**	(b)								

Answers to the Theoretical Questions

1. Please refer paragraph 4

2. Please refer paragraph 4.1

3. Please refer paragraph 8

4. Please refer paragraph 7

Answers to the Practical Problems

1. (i) Calculation of equivalent units of production:

Input Details	Units	Output Particulars	Units	Equivalent Units			
				Material		Conversion cost	
				%	Units	%	Units
Unit Introduced	10,000	Finished output	8,000	100	8,000	100	8,000
		Closing W-I-P	2,000	100	2,000	25	500
Total	10,000	Total	10,000		10,000		8,500

(ii) Calculation of cost per equivalent unit

	Direct Material	Conversion costs
Total cost (₹)	33,000	17,000
Equivalent units	10,000	8,500
Cost per equivalent unit (₹)	3.30	2.00

(iii) The cost of closing work in process (WIP):

COSTS	EQUIVALENT UNITS	RATE (₹)	TOTAL COST (₹)
Direct Material	2,000	3.30	6,600
Conversion Costs	500	2.00	1,000
Total			7,600

The cost of finished products:

COSTS	EQUIVALENT UNITS	RATE (₹)	TOTAL COST (₹)
Direct Material	8,000	3.30	26,400
Conversion Costs	8,000	2.00	16,000
Total			42,400

2. (i) Calculation of equivalent units of production:

Input Details	Units	Output Particulars	Units	Equivalent Units			
				Material		Conversion cost	
				%	Units	%	Units
Beginning WIP	16,000	Completed Output: From beginning WIP	16,000	40	6,400	80	12,800
Unit Introduced	1,00,000	Completed output: From unit introduced	76,000	100	76,000	100	76,000
		Closing W-I-P	24,000	90	21,600	40	9,600
Total	1,16,000	Total	1,16,000		1,04,000		98,400

(ii) Calculation of cost per equivalent unit for conversion costs

Particulars	Amount (₹)
Direct Labour	1,82,880
Factory Overheads	3,91,160
	5,74,040
Equivalent Units	98,400
Cost Per Equivalent Unit (₹)	5.83

3. (i) Statement of equivalent production (Average cost method)

Particulars	Input Units	Particulars	Output Units	Equivalent Production			
				Material		Labour & O.H.	
				%	Units	%	Units
Opening WIP	4,000	Completed and transferred	14,000	100	14,000	100	14,000
Units introduced	16,000	Closing WIP	6,000	100	6,000	33-1/3	2,000
	20,000		20,000		20,000		16,000

(ii) Statement showing cost for each element

Particulars	Materials (₹)	Labour (₹)	Overhead (₹)	Total (₹)
Cost of opening work-in-process	6,000	1,000	1,000	8,000
Cost incurred during the month	25,600	15,000	15,000	55,600
Total cost: (A)	31,600	16,000	16,000	63,600
Equivalent units: (B)	20,000	16,000	16,000	
Cost per equivalent unit: (C) = (A ÷ B)	1.58	1	1	3.58

(iii) Statement of apportionment of cost

	Amount (₹)	Amount (₹)
1. Value of units completed and transferred (14,000 units × ₹ 3.58)		50,120
2. Value of Closing W-I-P:		
- Materials (6,000 units × ₹ 1.58)	9,480	
- Labour (2,000 units × ₹ 1)	2,000	
- Overheads (2,000 units × ₹ 1)	2,000	13,480

(iv) Process-I Cost Account

Particulars	Units	(₹)	Particulars	Units	(₹)
To Opening W-I-P	4,000	8,000	By Completed units	14,000	50,120
To Materials	16,000	25,600	By Closing W-I-P	6,000	13,480
To Labour	--	15,000			
To Overhead	--	15,000			
	20,000	63,600		20,000	63,600

4. (i) Statement of Equivalent Production

Particulars	Input Units	Particulars	Output Units	Equivalent Production			
				Material		Labour & O.H.	
				%	Units	%	Units
Opening WIP	2,000	Completed and transferred to Process-II	35,000	100	35,000	100	35,000
Units introduced	38,000	Normal Loss (5% of 40,000)	2,000	--	--	--	--
		Abnormal loss (Balancing	1,000	100	1,000	80	800

		figure)					
		Closing WIP	2,000	100	2,000	80	1,600
	40,000		40,000		38,000		37,400

(ii) Statement showing cost for each element

Particulars	Materials (₹)	Labour (₹)	Overhead (₹)	Total (₹)
Cost of opening work-in-process	80,000	15,000	45,000	1,40,000
Cost incurred during the month	14,80,000	3,59,000	10,77,000	29,16,000
Less: Realisable Value of normal scrap (₹ 20 × 2,000 units)	(40,000)	--	--	(40,000)
Total cost: (A)	15,20,000	3,74,000	11,22,000	30,16,000
Equivalent units: (B)	38,000	37,400	37,400	
Cost per equivalent unit: (C) = (A ÷ B)	40.00	10.00	30.00	80.00

(iii) Statement of Distribution of cost

	Amount (₹)	Amount (₹)
1. Value of units completed and transferred (35,000 units × ₹ 80)		28,00,000
2. Value of Abnormal Loss:		
- Materials (1,000 units × ₹ 40)	40,000	
- Labour (800 units × ₹ 10)	8,000	
- Overheads (800 units × ₹ 30)	24,000	72,000
3. Value of Closing W-I-P:		
- Materials (2,000 units × ₹ 40)	80,000	
- Labour (1,600 units × ₹ 10)	16,000	
- Overheads (1,600 units × ₹ 30)	48,000	1,44,000

(iv) **Process-I A/c**

Particulars	Units	(₹)	Particulars	Units	(₹)
To Opening W.I.P:			By Normal Loss (₹20 × 2,000 units)	2,000	40,000
- Materials	2,000	80,000	By Abnormal loss	1,000	72,000
- Labour	--	15,000	By Process-I A/c	35,000	28,00,000
- Overheads	--	45,000	By Closing WIP	2,000	1,44,000
To Materials introduced	38,000	14,80,000			
To Direct Labour		3,59,000			
To Overheads		10,77,000			
	40,000	30,56,000		40,000	30,56,000

Normal Loss A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Process-I A/c	2,000	40,000	By Cost Ledger Control A/c	2,000	40,000
	2,000	40,000		2,000	40,000

Abnormal Loss A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Process-I A/c	1,000	72,000	By Cost Ledger Control A/c	1,000	20,000
			By Costing Profit & Loss A/c		52,000
	1,000	72,000		1,000	72,000

5. (i) Process I – Statement of Equivalent Production

Particulars	Completed Units	Closing stock of WIP			Equivalent Production units
		Units	% of Completion	Equivalent Units	
	(1)			(2)	(1) + (2)
Material	30,000	10,000	100%	10,000	40,000
Wages	30,000	10,000	50%	5,000	35,000
Overhead	30,000	10,000	50%	5,000	35,000

Process I

Particulars	Process Cost (₹)	Equivalent Production (units)	Process Cost p.u. (2)/(3)	WIP stock Equivalent units	Cost of WIP Stock (₹) (4) x (5)	Transfer to Process II (2)-(6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Material	15,000	40,000	0.375	10,000	3,750	11,250
Wages	18,000	35,000	0.514	5,000	2,570	15,430
Overhead	12,000	35,000	0.343	5,000	1,715	10,285
	45,000				8,035	36,965

Process I A/c

	Particulars	Unit	(₹)		Particulars	Units	(₹)
To	Direct material	40,000	15,000	By	Process II A/c	30,000	36,965
To	Direct wages	--	18,000	By	Closing W-I-P	10,000	8,035
To	Factory overhead	--	12,000			--	--
		40,000	45,000			40,000	45,000

(ii) Process II – Statement of Equivalent Production

Particulars	Completed Units	Closing stock of WIP			Equivalent Production units
		Units	% of Completion	Equivalent Units	
	(1)			(2)	(1) + (2)
Material	28,000	1,800	100%	1,800	29,800
Wages	28,000	1,800	25%	450	28,450
Overhead	28,000	1,800	25%	450	28,450

Process II

Particulars	Process Cost (₹)	Equivalent Production (units)	Process Cost p.u. (2)/(3)	WIP stock Equivalent units	Cost of WIP Stock (₹) (4) x (5)	Transfer to Finished Stock (2)-(6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Material	36,965	29,800	1.240	1,800	2,232	34,733
Wages	3,500	28,450	0.123	450	55	3,445
Overhead	4,500	28,450	0.158	450	71	4,429
	44,965				2,358	42,607
Add: Packing Material Cost						4,000
Cost of Finished Stock						46,607

Process II A/c

	Particulars	Units	(₹)		Particulars	Units	(₹)
To	Process I	30,000	36,965	By	Finished Stock	28,000	46,607
To	Direct wages	--	3,500	By	Normal loss	200	--
To	Factory overhead	--	4,500	By	WIP stock	1,800	2,358
To	Packing charges	--	4,000				
		30,000	48,965			30,000	48,965

6. (i) Statement of Equivalent Production

Particulars	Input Units	Particulars	Output Units	Equivalent Production			
				Sugarcane		Labour & O.H.	
				%	Units	%	Units
Opening WIP	4,500	Completed and transferred to Process - II	39,500	100	39,500	100	39,500
Units introduced	1,00,000	Normal Loss (55%* of 1,00,000)	55,000	--	--	--	--
		Abnormal loss	1,000	100	1,000	80	800
		Closing WIP	9,000	100	9,000	80	7,200
	1,04,500		1,04,500		49,500		47,500

*** 100 kg of sugarcane extracts only 45 litre of juice.**

Thus, normal loss = 100 – 45 = 55%

(ii) Statement showing cost for each element

Particulars	Sugarcane (₹)	Labour (₹)	Overhead (₹)	Total (₹)
Cost of opening work-in-process	50,000	15,000	45,000	1,10,000
Cost incurred during the month	5,00,000	2,00,000	6,00,000	13,00,000
Total cost: (A)	5,50,000	2,15,000	6,45,000	14,10,000
Equivalent units: (B)	49,500	47,500	47,500	
Cost per equivalent unit: (C) = (A ÷ B)	11.111	4.526	13.579	29.216

(iii) Statement of Distribution of cost

		Amount (₹)	Amount (₹)
1.	Value of units completed and transferred (39,500 units × ₹ 29.216)		11,54,032
2.	Value of Abnormal Loss:		
	- Sugarcane (1,000 units × ₹ 11.111)	11,111	
	- Labour (800 units × ₹ 4.526)	3,621	
	- Overheads (800 units × ₹ 13.579)	10,863	25,595
3.	Value of Closing W-I-P:		
	- Sugarcane (9,000 units × ₹ 11.111)	99,999	
	- Labour (7,200 units × ₹ 4.526)	32,587	
	- Overheads (7,200 units × ₹ 13.579)	97,769	2,30,355

(iv) Process-I A/c

Particulars	Units	(₹)	Particulars	Units	(₹)
To Opening W.I.P:			By Normal Loss	55,000	--
- Sugarcane	4,500	50,000	By Abnormal loss [₹ 25,595 + ₹ 18 (difference due to approxi-mation)]	1,000	25,613
- Labour	--	15,000	By Process-II A/c	39,500	11,54,032
- Overheads	--	45,000	By Closing WIP	9,000	2,30,355
To Sugarcane introduced	100,000	5,00,000			
To Direct Labour		2,00,000			
To Overheads		6,00,000			
	104,500	14,10,000		104,500	14,10,000

ANSWERS TO THE CASE SCENARIOS

1.

i.	(d)	**ii.**	(a)	**iii.**	(b)	**iv.**	(a)	**v.**	(c)

i. d

Inflow into process	Litres	Outflow from process	Litres
Opening WIP	500	Transferred to finished goods	3,400
Quantity introduced (Balancing figure)	3,800	Total loss	800
		Closing WIP	100
	4,300		4,300

ii. a

Total loss	800 litres
Normal loss (10% of fresh input i.e. 3,800)	380 litres
Abnormal loss	420 litres

iii. b

Calculation of Equivalent production units

Input Details	Units	Output Particulars	Units	Equivalent Production					
				Material		Labour		Overheads	
				%	Units	%	Units	%	Units
Opening WIP	500	From Opening WIP	500	-	-	20	100	40	200
Fresh inputs	3,800	From fresh units	2900	100	2900	100	2900	100	2900
		Normal loss	380	-		-		-	
		Closing WIP	100	100	100	20	20	10	10
		Abnormal loss	420	100	420	100	420	100	420
	4,300		4,300		3,420		3,440		3,530

Value of raw materials introduced during the month

	Equivalent units	Cost per EU (₹)	Total cost (₹)
Total value of raw material	3420	300	10,26,000
Add: Scrap value of normal loss	380	20	7,600
Value of raw material introduced			**10,33,600**

iv. a Value of labour and overhead in closing Work in process

Cost elements	Equivalent units	Cost per EU (₹)	Total cost (₹)
Labour	20	200	**4,000**
Overheads	10	160	**1,600**

v. c Value of output transferred to finished goods

Output transferred (Units) × Equivalent cost per unit

3,400 Litres × ₹660 = ₹22,44,000