Workings

	Total increase Rs.	Ineffective portion		Effective portion	
Cost of materials (20%)		%	Rs.	%	Rs.
[(Rs. 3,70,000 – Rs. 10,000) × 20/120]	60,000	15%	45,000	5%	15,000
Wages (20%)					
[(Rs. 1,20,000 + Rs. 30,000) × 20/120]	25,000	10%	12,500	10%	12,500
	85,000		57,500		27,500

40% of Rs. 27,500 = Rs. 11,000

Therefore, contract price is to be increased by Rs. 11,000.

6.4 Process Costing

6.4.1 Introduction

Process costing, as stated earlier, is a method of costing used for ascertaining costs of all the processes/operations involved in converting materials into finished products. It may be mentioned that, except in cases where a single unit of a product is produced in a process, unit product costs can not be ascertained directly under this method; only common costs for all the products produced smultaneously in a process are ascertained; common costs are then averaged to get product costs. When more than one process are involved, the average unit costs in all such processes are aggregated to get the total unit cost of a product.

6.4.2 Distinction between Job Costing and Process Costing

The main points of distinction between job costing and process costing are summarized below :

i) In job costing, goods are produced as per customer's specification; so goods are not homogeneous. In process costing, specifications are standardised; so goods are homogeneous.

ii) In job costing, jobs are terminable and costs are accumulated job-wise. Since processes are continuous, costs in process costing are accumulated process-wise for each period.

iii) Each production unit in job costing remains identifiable during production stage while production units may not be identifiable during processing.

iv) A product and its cost is generally not required to be transferred from one job to another while a product and so also its cost partly processed in one process is almost always transferred to the next process for further processing and completion.

v) Work-in-progress is more or less a common and significant feature in process costing while it is not so common in job costing.

6.4.3 Costing Procedure

With the ultimate objective of ascertaining cost of a product passing through different processes, the following procedure is to be followed :

i) The entire factory is divided into identifiable processes which are treated as cost centers. Separate accounts are opened for each such process.

ii) The elements of costs as collected for each process are debited to the respective process accounts.

iii) Output of each process is also similarly recorded in suitable units.

iv) Average cost per unit of output is computed by dividing the total cost for running a process throughout the accounting period by the total number of good units produced during the same period. Element wise cost per unit can also be computed if this process is carried out for each element of cost.

v) If a product has to pass through more than one process, the cost incurred in a process is to be transferred to the next process and the costs are thus accumulated.

Various elements of costs that may be involved in any process are :

Materials : Direct materials may be required to be issued only in the first process or may be required at each process. Output of one process, if transferred, may be treated as input material in the next process. Whatever may be the case, the cost of materials is to be debited to the respective process account.

Direct Labour : Similar to direct materials cost, direct labour cost in a process is to be debited to the respective process account. In case the labour employed serves a number of processes, the wages are to be allocated to the processes in proportion to the time spent in different processes.

Direct Expenses : Hire charge of special plant, depreciation, repairs and maintenance, etc. constitute direct expenses of a process. These costs are also to be debited to the respective process account.

Overheads : Problem of overheads is one of apportionment amongst the products and processes. In any case, actual overhead apportioned to a process is to be debited to the process account.

The costing procedure as described above is so simple that it hardly needs any explanation. But the complexity arises by the presence of some features peculiar to process industries only. Accordingly, costing procedure for process industries is taken up for discussion dividing it into the following different sections; each such section deals with a particular type of complexity :

A) When process *gains or losses* are involved,

B) When transfer of output from one process to the next is made at a *profit*,

C) When opening and / or closing *work-in-progress* exists in a process, and

D) When two or more different products are produced *simultaneously* from a single process.

6.4.4 Process Gains or Losses

Materials losses, output being less than input, are almost inherent in all process operations and are normally unavoidable. The volume of loss is usually dependent on the characteristics of the materials used (e.g., evaporation, shrinkage, etc.), the nature of process operation (e.g., chemical reaction), and other technicalities involved. So, it can be estimated on the basis of past knowledge / experiences in those factors and is expressed in terms of certain percentage of the materials input. This allowance towards loss which can be normally estimated is termed as *Normal Loss*.

The actual loss may, however, be more or less than the normal estimation owing to some abnormal factors like use of sub-standard or high quality materials, accidents, change in plant-design, etc. The loss over and above the normal loss is known as *Abnormal Loss*. On the other hand, *Abnormal Gain* results when actual loss is less than the normal loss.

Accounting treatments for normal loss, abnormal loss and abnormal gain differ. These are :

a) For Normal Loss : The cost that is proportionately assignable to normal loss units are to be absorbed by the good units produced, thus inflating the costs of the latter. This can be given effect to by simply ignoring any accounting entry. But if the scrap units (arising out of normal loss) do have any realizable value, that is to be credited to Process A/c to reduce the cost effect on the good units to that extent. The journal entries are :

i)	Normal Loss A/c Dr. }		With the expected realizable scrap value
	To Process A/c }		Do
ii)	Cost Ledger Control (C.L.C.) A/c Dr. }		For realization on sale of scrap
	To Normal Loss A/c }		Do

b) For Abnormal Loss : The cost attributable to abnormal loss units i.e., additional units lost, is, however, to be segregated not to burden the cost of good units. The cost so attributable is ascertained by treating these lost (abnormally) units as *equivalent* to good units. It may be mentioned that abnormal loss occurs along with (never in isolation of) normal loss : so accounting entries for normal loss remain as above. Other entries are :

i)	Abnormal Loss A/c Dr. }		With the attributable cost
	To Process A/c }		Do
ii)	C.L.C. A/c	Dr.	(For amount realized on sale as scrap)
	Costing Profit & Loss A/c	Dr.	(For balance amount)
	To Abnormal Loss A/c		(With attributable cost)

c) For Abnormal Gain : It is similar but opposite to abnormal loss. Abnormal loss units are actually a part of normal loss units which have turned to be good units. So, it reduces the number of scrap units that may be available for sale. The journal entries, therefore, are :

i) Normal Loss A/c Dr. } With the scrap value on expected normal loss units
To Process A/c } Do

ii) Process A/c Dr. } With the cost attributable to abnormal gain units
To Abnormal Gain A/c } Do

Cost per unit = [A – (B.C)] / (D – B)

where, A = Total cost charged to the process
B = Number of normal loss units
C = Scrap value per unit
D = Input units.

iii) Abnormal Gain A/c Dr. (For attributable cost)
To Normal Loss A/c (For scrap value lost)
To Costing Profit & Loss A/c (For balance amount)

iv) C.L.C. A/c Dr. } For realized scrap value
To Normal Loss A/c } Do

6.4.5 Inter-process Profit

Some industries may decide to assess the operating efficiency of each of the processes separately. For the purpose they may follow the system of transferring outputs (which are actually semi-finished in terms of the finished product) of a process (known as transferor process) to the transferee process at a price (not simply cost) which includes an element of profit. This element of profit included in the transfer price is known as *inter-process profit*. This system will not unduly distort the profitability of the firm since the profit arising on transfer will automatically be set off against the increased cost of the input to the transferee within the same firm.

Advantages :

i) It permits comparison of costs of both the inputs and outputs of a process with their market prices even at the intermediate stages of completion.

ii) Neutral performance assessment of individual processes gets facilitated.

Disadvantages :

i) It increases accounting complexities.

ii) Further complexity arises when a part of the stocks received on transfer remains unsold. Because it will require exclusion of unrealized profit for valuation of such unsold stock at 'lower of cost or market price'. The profit figure to be credited to Profit & Loss A/c should also be adjusted by an amount of provision that may be created for such unrealized profit.

Problem (Inter-process Profit)

Product X passes through two processes before it is completed and transferred. The following data are made available for the month of June, 2005 :

Particulars	Process I Rs.	Process II Rs.	Finished Stock Rs.
Opening stock	5,000	8,000	22,000
Direct materials	26,000	20,500	
Direct wages	14,000	14,000	
Factory overhead	12,000	8,000	
Closing stock	3,500	5,500	12,500
Inter-process profit included in opening stock	---	1,200	7,500
Profit on transfer (% on transfer price)	20%	10%	---

Process stocks are valued at prime cost while finished stockes are valued at the price at which these are received from Process II. Sales during the period are Rs. 1,67,694. You are required to :

i) Prepare Process Accounts and Finished Stock Account showing profits at each stage,

ii) Compute realized profit, and

iii) Compute stock values for balance sheet purpose.

Solution :

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

	Rs.	Rs.		Rs.	Rs.
To Opening Stock	5,000		By Process II A/C		
Direct materials	26,000		- transfer		79,375
Direct wages	14,000				
	55,000				
Less Closing stock	3,500				
Prime Cost		51,500			
To Factory Overhead		12,000			
Process Cost		63,500			
To Profit (20% on tranfer price i.e., 25% on cost)		15,875			
		79,375			79,375

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

	Rs.	Rs.		Rs.	Rs.
To Opening Stock	8,000		By Finished		
To Process I A/c			Stock A/c		
- transfer	79,375		- transfer		1,38,194
To Direct Materials	20,500				
To Direct Wages	14,000				
	1,21,875				
Less Closing stock	5,500				
Prime Cost		1,16,375			
To Factory Overhead		8,000			
Process Cost		1,24,375			
To Profit (10% on transfer price i.e., 1/9th of cost price)		13,819			
		1,38,194			1,38,194

Dr. **Finished Stock Account** **Cr.**

	Rs.	Rs.		Rs.	Rs.
To Opening Stock	22,000		By Sales		1,76,694
To Process II A/c			A/c		
-transfer	1,38,194				
	1,60,194				
Less Closing Stock	12,500				
Cost of Goods Sold		1,47,694			
To Profit		20,000			
		1,67,694			1,67,694

Total Profit as per above accounts may be summarized as shown below :

	Rs.
Process I A/C	15,875
Process II A/C	13,819
Finished Stock	20,000
	49,694

ii) Computation of Realised profit involves a process of estimation of the unrealised profits included in stocks in both the processes and in finished goods. This is shown below :

Particulars	**Unrealised Profit** Rs.	**Adjustment for Unrealised Profit** Rs.	**Realised Profit** Rs.
A) Process I			
Apparent Profit as shown in Process I A/C		15,875	
Add Profit in opening Stock	NIL		
Less Profit in closing Stock	NIL		
Net adjustment		NIL	15,875
B) Process II			
Apparent Profit as shown in Process II A/C		13,819	
Add Profit included in Opening Stock as given	1,200		
Less Profit included in Closing Stock-Proportionate profit as charged by Process I [{(1,200 + 15,875)/1,21,875} × 5,500]	(771)		
Net adjustment		429	14,248
C) Finished Goods			
Apparent Profit as shown in Finished Stock A/C		20,000	
Add Profit included in Opening Stock as given	7,500		
Less Profit in Closing Stock [{(7,500 + 13,819)/1,60,194} × 12,500]	(1,664)		
Net adjustment		5,836	
			25,836
			55,259

iii) *Closing Stock values for Balance Sheet purposes*

	Gross Value Rs.	Unrealised Profit Rs.	Balance Sheet Value Rs.
Process I	3,500	NIL	3,500
Process II	5,500	771	4,729
Finished Goods	12,500	1,664	10,836
	21,500		19,065

6.4.6 Process Work-in-progress

In process industries, processing operations are usually continuous. So, it is quite likely that on the date of closing the accounts there remain some production units which are still under processing and have been consuming resources. These production units may be at different degrees of completion with respect to different elements of costs. It causes problem in determining the number of units fully completed during an accounting period. In process costing, we cannot identify the costs with each physical unit separately. So, for determining cost per unit what is actually done is that the total cost during a period is divided by the total number of units completely produced during the same period. It, therefore, necessitates conversion of semi-finished production units into *equivalent* number of completed units. The whole procedure of ascertaining cost of production per unit can be summarised as follows :

i) Ascertaining *Equivalent Production*, giving due consideration to the process losses and to the opening and closing work-in-process with their respective degrees of completion,
ii) Ascertaining the total *Process Costs* with element wise break up,
iii) Ascertaining *Cost per Unit* of Equivalent Production, and
iv) Ascertaining values of (a) completely processed and transferred units, and (b) Work-in-progress.

The above steps essentially involve preparation of the following three working statements :

i) Statement of Equivalent Production – dealing with the first step.
ii) Statement of Cost – dealing with the second and third steps.
iii) Statement of Evaluation – dealing with the last step.

Again, the preparation of the above statements may involve different degrees of attention to deal with different situations like there being only closing work-in-progress, with no process losses or process losses and gains. So, for easy understandability we take up discussions under the following separate heads :

a) Only closing Work-in-progress and no process gains and losses,
b) Only closing Work-in-progress but with process gains and losses,
c) Both types of WIPs with or without process gains and losses.

a) Only closing WIP but no process loss

This is the simplest situation; the only complexity is that related to the elementwise conversion of incomplete units of closing WIP into equivalent number of completely processed units. For example, we assume that there are 100 units of closing WIP which are 100% complete with respect to materials, 60% complete with respect to labour and 40% complete with respect to overhead. Its Conversion may be shown as follows :

Element	Closing WIP		Corresponding Equivalent Production Units
	No. of Units	Degree of Completion	
Materials	100	100%	100*100% = 100
Labour	100	60%	100*60% = 60
Overhead	100	40%	100*40% = 40

Once we complete the above conversion the rest part is very easy and similar to other situations. The entire process is illustrated in a later section.

b) Only closing WIP but with process gains and losses

The following points are worth noting :

i) Normal loss units are ignored for the purpose of conversion into Equivalent Production. But the realizable scrap value, if any. is to be deducted from the material cost.

ii) Abnormal loss units are to be converted taking into consideration the stage (degree of completion) when these are lost. If the information as to the degree of completion at the time of losing or rejection is not available it is to be assumed that losses occur at the Final stage i.e., when these are 100% complete in all respects.

iii) Abnormal Gain units are always to be taken as 100% complete in all respects.

c) Having both the opening and closing WIPs

Existence of opening WIP makes the unit cost computation process further complex. Conversion results for opening WIP would vary depending on whether FIFO method or Weighted Average Cost method is assumed. So, discussions are taken up in the following paragraphs to deal with the issues separately. It may be mentioned that the issues of existence or absence of process gains and losses can be handled following the same methods as discussed under (a) and (b) above.

i) Weighted Average Cost Method

Under this method, the degree of completion of opening WIP is considered irrelevant since these units are bundled with the category of units 'completed and transferred' during the period. So, effectively opening WIP units are treated alike with the units which are completely processed (i.e., 100%) during the period. The value

of opening WIP with the element wise break up is, however, to be added to the respective elements of cost incurred during the current period.

Problem

The following information is available in respect of an intermediate process (No. 2) for the month of April. 2005 :

Opening WIP : 1,000 units made up of :

Process I cost	Rs. 2,000
Materials	Rs. 4,500 (60% complete)
Labour	Rs. 3,600 (40% complete)
Overhead	Rs. 3,000 (30% complete)

Transfer from Process I : 19,000 units at Rs. 58,000

Transfer to Process III : 17,500 units

Process costs during the month :

Materials	Rs. 84,000
Labour	Rs. 66,800
Overhead	Rs. 32,000

Normal Loss : 10% of the input

Scrap value : Rs. 3 per unit

Closing WIP : 1,000 units; Degree of Completion :
Materials 70%, Labour 60%, Overhead 50%.

Prepare necessary statements and Process II Account.

Solution (Weighted Average Method)

Statement of Equivalent Production

Input		Output		Equivalent Production							
Items	**Units**	**Items**	**Units**	**Materials I**		**Materials II**		**Labour**		**Overhead**	
				%	**Units**	**%**	**Units**	**%**	**Units**	**%**	**Units**
Opening WIP	1,000	Completely processed and transferred	17,500	100	17,500	100	17,500	100	17,500	100	17,500
Transfer from Process I	19,000	Normal Loss	2,000	---	---	---	---	---	---	---	---
		Closing WIP	1,000	100	1,000	70	700	60	600	50	500
		Total	20,500		18,500		18,200		18,100		18,000
		Less Abnormal Gain	500	100	500	100	500	100	500	100	500
	20,000		20,000		18,000		17,700		17,600		17,500

Notes **:** 1) Cost that is transferred from earlier process is designated as Materials I and materials of this process as Materials II.

2) Normal Loss = 10% of (1000 + 19000).

Statement of Cost

Elements of Cost	**Cost Rs.**	**Equivalent Production Units**	**Cost per unit Rs.**
Materials I :			
Opening WIP	2,000		
Transfer from Process I	58,000		
	60,000		
Less Scrap Value :			
2,000 units @ Rs. 3	6,000		
	54,000	18,000	3
Materials II :			
Opening WIP	4,500		
Added in Process II	84,000		
	88,500	17,700	5
Labour :			
Opening WIP	3,600		
Added in Process II	66,800		
	70,400	17,600	4
Overhead :			
Opening WIP	3,000		
Added in Process II	32,000		
	35,000	17,500	2
			14

Statement of Evaluation

	Units	**Rate Rs.**	**Amount Rs.**	**Total Rs.**
Completed Production				
Materials I	17,500	3	52,500	
Materials II	17,500	5	87,500	
Labour	17,500	4	70,000	
Overhead	17,500	2	35,000	2,45,000

Abnormal Gain				
Materials I	500	3	1,500	
Materials II	500	5	2,500	
Labour	500	4	2,000	
Overhead	500	2	1,000	7,000
Closing WIP				
Materials I	1,000	3	3,000	
Materials II	700	5	3,500	
Labour	600	4	2,400	
Overhead	500	2	1,000	9,900

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

	Units	**Amount Rs.**		**Units**	**Amount Rs.**
To Opening WIP	1,000	13,100	By Normal Loss	2,000	6,000
To Process I A/c			By Process III A/c		
-- transfer	19,000	58,000	-- transfer	17,500	2,45,000
To Materials		84,000	By Closing WIP	1,000	9,900
To Labour		66,800			
To Overhead		32,000			
To Abnormal Gain A/c	500	7,000			
	20,500	2,60,900		20,500	2,60,900

ii) FIFO Method

This method differs from the earlier method only in respect of dealing with the processing and completion of opening WIP units. Under this method it is assumed that opening WIP units are completed first; so, in conversion of these units into equivalent production units the fact that a part of the production process has been completed in the earlier period and only the residual part has been completed in the current period has to he given effect to. Thus, the costs of the current period (obviously excluding the cost / value of opening WIP brought forward from the earlier period) are to be apportioned amongst the equivalent production units taking into consideration only the percentage of work completed during the current period so far as opening WIP is concerned. The method is demonstrated below using the ***same problem*** as used for Weighted Average Method.

Solution (FIFO Method)

Statement of Equivalent Production

Input		Output		Equivalent Production							
Items	Units	Items	Units	Materials I		Materials II		Labour		Overhead	
				%	Units	%	Units	%	Units	%	Units
Opening WIP	1,000	Opening WIP	1,000	---	---	40	400	60	600	70	700
Transfer from Process I	19,000	Completely processed (17,500–1,000)	16,500	100	16,500	100	16,500	100	16,500	100	16,500
		Normal Loss	2,000	---	---	---	---	---	---	---	---
		Closing WIP	1,000	100	1,000	70	700	60	600	50	500
		Total	20,500		17,500		17,600		17,700		17,700
		Less Abnormal Gain	500	100	500	100	500	100	500	100	500
	20,000		20,000		17,000		17,100		17,200		17,200

Notes **:** 1) Cost that is transferred from earlier process is designated as Materials I and materials of this process as Materials II.

2) Normal Loss = 10% of (1000 + 19000).

Statement of Cost

Elements of Cost	Cost Rs.	Equivalent Production Units	Cost per unit Rs.
Materials I :			
Transfer from Process I	58,000		
Less Scrap Value :			
2,000 units @ Rs. 3	6,000		
	52,000	17,000	3,059
Materials II :			
Added in Process II	84,000	17,100	4,912
Labour :			
Added in Process II	66,800	17,200	3,884
Overhead :			
Added in Process II	32,000	17,200	1,860
			13,715

Statement of Evaluation

	Units	Rate Rs.	Amount Rs.	Total Rs.
Opening WIP :				
Materials II	400	4.912	1,965	
Labour	600	3.884	2,330	
Overhead	700	1.860	1,302	5,597
Completed Production	16,500	13.715	2,26,304*	2,26,304
Abnormal Gain	500	13.715	6,858	6,858
Closing WIP :				
Materials I	1,000	3.059	3,059	
Materials II	700	4.912	3,438	
Labour	600	3.884	2,330	
Overhead	500	1.860	930	9,757

*Figure is adjusted for fraction

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

	Units	Amount Rs.		Units	Amount Rs.
To Opening WIP	1,000	13,100	By Normal Loss	2,000	6,000
To Process I A/c -- transfer	19,000	58,000	By Process III A/c -- transfer	17,500	2,45,001*
To Materials		84,000	By Closing WIP	1,000	9,757
To Labour		66,800			
To Overhead		32,000			
To Abnormal Gain A/c	500	6,858			
	20,500	2,60,758		20,500	2,60,758

Notes **:** Value of Transfer to Process III : Rs.

Opening WIP : Cost in the previous period	13,100
Cost in the current period (as per Evaluation Statement)	5,597
Completely processed (as per Evaluation Statement)	2,26,304*
	2,45,001

*Figure is adjusted for fraction.

6.4.7 Simultaneous Production of Different Products

In process industries there may be some processing operations in which two or more different products may be processed simultaneously in the same operation. So, in such cases both the processes and the costs may be common, either in full or in part, for the products getting processed. The products, however, may be different in

terms of volume, size, nature, value, resource consumption, scope for processing after separation, etc. These variations make accounting treatments complex. Before taking up discussion on accounting for costs we must have a clear understanding about a few commonly used terms. These are discussed below.

Joint Product

When two or more products of equal importance are simultaneously produced by a common process or a set of common processes, such products are known as joint products. Importance is judged in terms of value or the objectives of production to the company. For example, in oil refinery, products produced like fuel oil, lubricants, coal tar, paraffin, gasoline, etc., are joint products. Similarly, in dairy industries, milk, butter, cream, cheese, etc., are joint products.

By-Product

When one or more of the products that come out of the common process / es is / are of lesser economic value or incidentally produced (production process being carried out for production of other main product/s), such product/s (other than the main product/s) is/are known as by-product. Examples of by-products may include : saw-dust and off-cuts in saw mills, cow-dung in dairy, bones in meat industry, oil-cakes in oil extraction units, etc.

Co-product

Co-products are similar to joint products but they may not come out of the same operation or from using same raw materials. Common examples may be : chair, table, etc., manufactured in a furniture manufacturing unit. Co-products have more dissimilarities than similarities with the by-products. Common areas being negligible separate discussion on accounting for co-products is avoided.

We have discussed about process gains and losses in earlier section (6.4.4). There we have categorized gains and losses on the basis of ***normality***. For better management and disposal of lost units, we can additionally classify process losses on some other bases. These are discussed below in brief.

Classification on the basis of ***recoverable value*** :

i) ***Waste***

If and when some portion of raw materials is discarded in the production process such that the discarded materials have no realizable value, the materials so discarded are known as wastes. Accounting treatment for waste materials is guided by whether the waste is normal or abnormal. Cost of normal waste is to be absorbed in the cost of good production units while that of abnormal waste is to be transferred to Costing Profit and Loss Account.

ii) ***Scrap***

Materials as discarded in the production process, which are having some recoverable values without further processing, are known as scraps. The scraps are either disposed or reintroduced as raw materials.

There are alternatives of accounting treatment for scrap.

If scraps are of insignificant value the cost of the scraps is ignored i.e., not deducted from the cost of materials introduced; the realized amount, if any, on sale of scrap is treated as other income. The realized amount can alternatively be credited to overhead resulting in reduction in the overhead rate. Yet another alternative to deal with the realized amount is to deduct it from the material cost. On the other hand if cost is identifiable with a particular process and is of significant value, the cost of the scrap is debited to a Scrap Account against a credit to the identified Process Account. Any profit or loss on sale of scrap is transferred to Costing Profit and Loss Account.

Classification on the basis of ***rectifiability*** :

i) ***Defectives***

While the terms 'waste' and 'scrap' are used in relation to raw materials, the terms 'defectives' and 'spoilage' under this classification are generally used in relation to the processed materials towards finished goods. The production units which fail to satisfy the specifications for standard products but which can be re-worked or reconditioned by use of additional raw materials, labour or processing to transform them into standard product or sub-standard product, are known as defectives.

Accounting for defectives essentially means accounting for the cost of rectification. If such defective productions are abnormal, the cost is charged to Costing Profit and Loss Account. If, however, defectives are normal, the cost is ignored and left to be absorbed by good production units. Alternatively, the cost may be treated as overhead-departmental overhead if department responsible for detectives can be identified and general overhead if department cannot be identified. Yet in situations where it is identifiable with a specific job, it is better to charge the cost to the job.

ii) ***Spoilage***

When production units are so damaged during processing that they are not worth-rectification, they are known as spoilage. In case of normal spoilage the cost is either charged to production order account or production overhead account and the realizable amount, if any, is credited to the corresponding account. The cost of abnormal spoilage is charged to Costing Profit and Loss Account.

6.4.8 Accounting for Simultaneously Produced Products

There may be two types of products under simultaneous production : Joint Product and By-Product (co-products are excluded as stated earlier). The issue to be discussed under this section relate to determination of the cost of production of these products. All its problems centre around apportionment of joint costs. Joint cost is the cost incurred jointly for all the products and not identifiable with the individual products. Costs incurred on the products can be separated if they are identifiable with individual product/s and therefore, such costs do not pose any problem. Methods of apportionment may be significantly different depending on whether by-product is also there or not. Accordingly, discussion is taken up under the following two separate heads :

i) Where there is no by-product, and

ii) Where there are both the joint product and the by-product.

i) *Only Joint Products*

There are a good number of alternative methods that are used for apportioning joint costs. These are discussed below :

1) *Average Unit Cost Method*

This is the simplest method where the total joint costs are divided by the total number of units produced taking all the joint products into account to determine the average cost per unit. It is needless to mention that under this method all the different joint products are treated alike in terms of costing and pricing. The method, however, fails if the products differ in quality deserving different price attribution or if the products are not measurable in any common unit.

2) *Physical Unit Method*

Under this method a common physical base like any measure of raw materials (unit, weight, volume, etc.), labour hour, etc., is identified and the total joint costs are divided by the aggregate measure of the common physical unit. It gives us the cost per unit of common physical base. This rate is then applied to determine the cost per unit of the joint products. Finding a common physical base is a precondition which may stand on the way of applying this method.

Example

Joint costs Rs. 50,000

Production data :

Products	Production Units	Labour Hours used
X	1,000	500
Y	2,000	400
Z	2,500	100
		1000

Here, common physical unit is labour hour.

So, joint cost per labour hour = Rs. 50,000/1000 hrs. = Rs. 50.

Joint cost is to be apportioned as shown below :

Products	Share of joint costs Rs.	Production units	Cost per unit Rs.
X	500 hrs. @ Rs. 50 = 25,000	1,000	25
Y	400 hrs. @ Rs. 50 = 20,000	2,000	10
Z	100 hrs. @ Rs. 50 = 5,000	2,500	2

3) ***Survey Method***

To obviate the limitation of finding out a common physical unit for the joint products, sometimes a number of such different factors are considered as bases for apportionment of joint costs. Each such factor is assigned point values considering its relative importance with respect to a particular product. We can thus have a point value per unit of each joint product. Joint costs are then apportioned on the basis of aggregate point values.

Example

Joint costs Rs. 68,000

Other information :

Products	Production Units	Point Values Per Unit			
		Raw Materials	Selling Price	Marketing Channels	Total
A	1,000	2	1	3	6
B	2,000	1	2	1	4
C	2,500	2	3	3	8

Apportionment of Joint Costs

Products	Units	Points p.u.	Total Points	Share of Joint Costs Rs.	Cost p.u. Rs.
A	1,000	6	6,000	6,000 × 2 = 12,000	12
B	2,000	4	8,000	8,000 × 2 = 16,000	8
C	2,500	8	20,000	20,000 × 2 = 40,000	16
			34,000		

Note : Share of cost per point : Rs. 68,000 / 34,000 Points = Rs. 2.

4) ***Standard Cost Method***

In industries where standard costing is in operation standards may easily be set for each type of joint products; joint costs are apportioned on that basis.

5) *Contribution Margin Method*

This method requires segregation of costs (both pre- and post-separation) into variable and fixed. In effect, it uses marginal costing technique. Unit Contribution for each product is then computed by deducting variable cost from selling price. Thus product wise total contribution can be calculated. Joint costs (pre-separation cost) are apportioned on that basis.

Example

Two products—A and B are produced jointly. Joint costs are : Direct Materials Rs. 20,000, Direct Labour Rs. 6,000, Variable overheads Rs. 4,000, and Fixed overheads Rs. 10,500.

Production and sales data are given below :

Products	Production	Selling Price
	Kgs.	Rs.
A	500	50
B	200	35
C	300	60

Apportion joint costs on the basis of contribution and compute profits for each product.

Solution

	A	B	C	Total
	Rs.	Rs.	Rs.	Rs.
Sales (Weight × Selling Price)	25,000	7,000	18,000	50,000
Less Variable Costs of Rs. 30,000 (20,000 + 6,000 + 4,000) apportioned on the basis of weights of production i.e., (5 : 2 : 3)	15,000	6,000	9,000	30,000
Contribution	10,000	1,000	9,000	20,000
Less Joint Fixed Costs of Rs. 10,500 apportioned on the basis of contributions i.e., (10 : 2 : 9)	5,000	1,000	4,500	10,500
Profit	5,000	NIL	4,500	9,500

6) *Market Value Method*

Under this method joint costs are apportioned in the ratio of market value of the products. So, the joint product with higher market value will bear proportion of joint costs. It is based on the assumption that there is a direct relationship between costs and market values. The method, therefore, fails if the assumed relationship does not hold good. Moreover, collection of market value information before actual selling or precise estimation of market value may pose problem. However, since a product may have different market values at two significant stages of production—at the point of

separation and at the end of further processing—this method has three variants. These are discussed below.

a) Market Value at the Point of Separation

The joint costs are apportioned in proportion to the market value of the products at the point of separation. The method is suitably applied when post-separation processing or other costs are disproportionate.

For example, apportionment of joint costs in the above example will be as shown below :

	A Rs.	B Rs.	C Rs.	Total Rs.
Sales	25,000	7,000	18,000	50,000
Less Joint Costs : Rs. 40,500 (20,000 + 6,000 + 4,000) + 10,500) apportioned in the ratio of 25 : 7 : 18)	20,250	5,670	14,580	40,500
Profit	4,750	1,330	3,420	9,500

b) Market Value after further Processing

This method is similar to the earlier method, the only difference being that market value at the end of final processing is to be used as the base for apportionment of joint costs.

c) Net Realisable Value Method

Under this method net realizable values of joint products are obtained by deducting profit margin, selling and distribution expenses and post-separation costs. Joint costs are apportioned in proportion of net realizable values of the products.

ii) Both the Joint Product and the By-product

Various methods of accounting that are in use for apportionment of joint costs in situations where both the joint products and the by-products are produced simultaneously can be divided into two categories : A) *Non-cost Methods*, and B) *Cost Methods*. Some of the methods ignore the by-products to make them bear the burden of any portion of joint costs. Those methods come under the first category. On the other hand, the methods which consider by-products to share some reasonable portion of joint costs fall under the second category. These are discussed below :

A) Non-cost Methods

Other Income Method : Any amount realizable on sale of by-products is treated as 'Other Income'. This method is suitable where the realizable value of by-products is negligible.

Total Sales less Total Costs : Under this method by-products are not considered worth paying attention-neither in terms of their pre-separation costs nor in terms of their sales value. In effect, sales values of by-products are included in the sales values of joint products. Thus, total costs (both pre-and post-separation) are deducted from total sales value to determine net profit.

Total Costs less Sales Value of By-products : Instead of assigning a portion of joint costs on the by-products, the amount of total costs is reduced by the sales values of by-products. The reduced value of total costs is then to be shared only by the joint products.

Total Costs less Sales Value of By-products : Instead of assigning a portion of joint costs on the by-products, the amount of total costs is reduced by the sales values of by-products. The reduced value of total costs is then to be shared only by the joint products.

Two other methods, like *Total Costs less value of by-products after setting off selling and distribution overheads of by-products* and *Total Costs Less net yield of by-products* are in no way different from the present method.

B) Cost Methods

Reverse Cost Method : Under this method a portion of joint costs is to be borne by the by-products. The amount of joint costs to be shared by the by-products is determined by what a particular by-product can bear after allowing an estimated profit margin for the by-product. The method is demonstrated below :

		By-Products		
		A		B
	Rs.	Rs.	Rs.	Rs.
Sales Value		XXX		XXX
Less : Estimated net profit	XXX		XXX	
Selling & Distribution exp.	XXX		XXX	
Post-separation processing costs	XXX	XXX	XXX	XXX
Share of Joint Costs		XXX		XXX

Comparative Price : Sometimes when by-products are of no or negligible value but the by-products are used as raw materials in the same organization, the value of the by-product is determined on the basis of the market value of similar or alternative raw material. The value so determined is credited to the process account resulting in a reduction in the joint costs to be borne by the joint products.

Standard Cost : This is similar to the above method, the only difference being that the value of the by-product that is to be credited to process account is determined on the basis of a predetermined standard.

Treating By-products alike Joint Products : In cases where by-products are also of significant values, they are treated like joint products and any suitable method of those available for apportionment of joint costs amongst the joint products may be applied.

6.4.9 Further Processing Decision or Depth of Processing

Sometimes joint products or by-products may not be profitable at the point of separation but may appear to be so after further processing. Thus a decision situation arises : whether to go for further processing. Decision principle is : *Go for further processing if the incremental revenue is greater than the cost of further processing*.

Problem

The costs of a manufacturing company for a year are as follows :

	Rs.
Direct Materials	1,30,000
Direct Wages	70,000
Production Overheads (100% of D. Wages)	70,000
Selling and Distribution Overheads	50,000
Sales during the year are :	
Joint Products : A	1,80,000
B	1,30,000
By-Products : X (5,000 units)	30,000
Y (2,000 units)	40,000

There is scope for further processing the by-products, which involves combining X with Y in the ratio of 10 : 1 to yield a new product Z with a sale value of Rs. 120 per unit. The following additional costs are to be incurred :

	Per unit of Z
	Rs.
Direct Materials	10
Direct Wages	2

A new plant costing Rs. 40,000, installation cost Rs. 5,000 is to be installed. It will have a scrap value of Rs. 3,000 at the end of its useful life of 10 years. Will you recommend further processing ?

Solution

			Rs.
Sales of possible production of Z : 500 units @ Rs. 120 p.u.			60,000
Less Sales of by-products before processing :			
(corresponding to production of Z)			
X : 5,000 units @ Rs. 6		30,000	
Y : 500 units @ Rs. 20		10,000	40,000
			20,000

Additional costs for production of Z :		
Direct Materials : 500 units @ Rs. 10 p.u.	5,000	
Direct Wages : 500 units @ Rs. 2 p.u.	1,000	
Production Overheads (100% of D. Wages)	1,000	
Depreciation [(40,000 + 5,000 – 3,000)/10 yrs]	4,200	11,200
Additional Profit		8,800

So, further processing and manufacture of Z is recommended.

Note : Manufacturing one unit of Z requires 10 units of X and 1 unit of Y, Although 2000 units of Y are sufficient to manufacture 2000 units of Z, 5000 units of X can produce only 500 units of Z.

6.5 Service Costing

Service costing is a method of costing used in organizations which render services instead of manufacturing goods. Examples include those providing transport services, utility services like hotels, canteens, hospitals, etc., distribution services like gas, electricity, etc., and professional services like accounting services, management consultancy, etc. The services may be exclusively for internal use or for the general public or for both. In any case, ascertainment of service costs is common but the method of allocation of these costs to cost units differs from that adopted in case of manufacturing organizations.

6.5.1 Cost Units in service costing

One of the peculiar features of service costing is that the proportion of fixed cost in the total cost is higher in general and usually the variation in costs is associated with double cost units. That is why composite units like passenger-km, bed-day, kilowatt-hour, etc. are more suitable.

6.5.2 Collection and Classification of Cost

Costs are collected and classified under suitable heads so selected as to facilitated cost control and decision making. Naturally, such classification will vary depending on the nature of the industries. Methods used in two such industries leading to ascertainment of cost per cost unit are discussed below.

6.5.3 Transport Costing

Transport industry covers a wide variety of industries like Road, Air and Water transport. Each of them may again be further divided and subdivided. We take up only Motor Transport for a brief discussion.

Costs and their classification

Motor transport costs are classified into three broad heads mainly on the basis of variability. These are

a) *Operating and running costs* : These are of variable nature and include petrol, oil, grease, etc., wages of driver, conductor, helper, etc., when they are paid on the basis of running time or distance, depreciation, etc.

b) *Maintenance costs* : These are of semi variable type and include tyres and tubes, repairs and paintings, overhauls, etc.

c) *Standing or Fixed costs* : Costs like salary of operating manager, supervisor, etc. Taxes, Insurance, License, Garage rent, Interest on capital, etc.

As in case of Job or Contract Costing, under Motor transport costing too each vehicle is given a separate number. Costs for a vehicle are collected through a Daily Log Sheet maintained by the driver of each vehicle. So, separate Log Sheets are maintained for different vehicles. Each such Log Sheet will bear the number assigned to a particular vehicle; this helps in maintaining and collecting costs for each vehicle separately. Daily Log Sheet is suitably designed to record all necessary information relating to the vehicle, its running and the costs.

Costs so collected from the Daily Log Sheet are then arranged in a Cost Sheet to spread over the appropriate number of cost units. It will give us an average unit cost.

Similar to Motor Transport, cost sheet can be prepared for Boiler House, Canteen, Hospital, Nursing Home, etc. For example, Canteen expenses may include the following :

i) Wages and Salaries,

ii) Provisions like meat, fish, egg, tea, biscuits, etc.

iii) Consumable Stores : cutlery, crockery, cleaning materials, wash clothes, etc.

iv) Services : steam, gas, electricity, etc.

v) Miscellaneous : Rent, Depreciation, Insurance, Maintenance, etc.

Problem

A transport company operates a fleet of lorries. Following information relating to a lorry (No 10) for the month of June 2005 was available :

A) *Operation information* :

Days maintained	30
Days operated	24
Total hours operated	250
Total kilometers covered	2700
Total tonnage carried	216

(4 tonnes load per trip, return journey empty)

B) *Cost information* :

i) Operating costs : Petrol Rs. l,600, Oil Rs. 300, Grease Rs. l50, Driver's wages Rs. 2000, Wages for Khalasi Rs. 1500.

ii) Maintenance costs : Repairs Rs. 650, Tyres Rs. 700, Garage rent Rs. 1000.

iii) Fixed costs : Insurance Rs. 1,500, License, tax, etc. Rs. 1,000, Interests 700, Other overheads Rs. 400.

iv) Capital costs : Acquisition cost Rs. 2,80,000, Residual value at the end of 10 years life Rs. 40,000.

Prepare a cost sheet and a performance statement showing :

a) Cost per day maintained,
b) Cost per day operated,
c) Cost per kilometer,
d) Cost per hour,
e) Cost per commercial tonne-km.

Solution

……. Transport Company Ltd.
Cost Sheet for the month of June 2005

	For the month (4,800 ton-km) Rs.	**Per Tonne-km Rs.**
1. *Operating Costs* :		
Petrol	1,600	0.333
Oil	300	0.063
Grease	150	0.031
Driver's Wages	2,000	0.417
Wages of Khalasi	1,500	0.313
	5,550	1.157
2. *Maintenance Costs* :		
Repairs	650	0.135
Tyres	700	0.146
Garage rent	1,000	0.208
	2,350	0.489
3. *Fixed Costs* :		
Insurance	1,500	
Licence, tax, etc.	1,000	
Interest	700	
Other overheads	400	
Depreciation [2,80,000 – 40,000)/(10 × 12)]	2,000	
	5,600	1,167
4. Total Costs [1 + 2 + 3 + 4]	13,500	2,813

Performance Statement

1.	Days maintained		30
	Total cost (Rs.)		13,500
	(a) Cost per day maintained (Rs.)	(13,500 / 30)	450
2.	Days operated		24
	(b) Cost per day operated (Rs.) (13,500 / 24)		563
3.	Idle days (30 – 24)		6
4.	Total kilometers covered		2,700
	(c) Cost per kilometer (Rs.)	(13,500 / 2700)	5
5.	Total hours operated		250
	(d) Cost per hour (13,500 / 250) (Rs.)		54
6.	Total number of trips [216 tonnes / 4 tons per trip]		54
7.	Total Ton-kilometer per month (2700 km / 54 trips) [50 kms × 4 tons × 24 days]		4,800
	(e) Cost per commercial ton-km (Rs.) [13,500 / 4,800]		2,813

6.6 Select Readings

Banerjee, B., *Cost Accounting*, World Press Pvt. Ltd.

Lal, Jawahar, *Cost Accounting*, Tata Mc Graw Hill Publishing Co. Ltd.

Wheldon, *Cost Accounting*, ELBS

6.7 Questions

(a) Long answer type

1. What are the main features of Job Order Costing ? Describe how costs of a job are collected for recording in Job Cost Card.
2. What is meant by 'Equivalent Production' ? How is it computed? Illustrate your answer with reference to the methods which are in common use.
3. Explain the distinction between Joint Product, By-product and Co-product. Give an outline of any four methods of valuing and costing by-products, selecting two methods from each of the 'non-cost' and 'cost' methods of accounting for by-products.

4. i) "The more kilometers you travel with your own vehicle, the cheaper it becomes."—Comment briefly on this statement.

   ii) What records should a Transport Company maintain in respect of each vehicle to determine cost per unit of services rendered ? Draw up a Cost Sheet of such a company assuming your own figures.

(b) Short answer type

i) Specify some industries where job costing can be suitably applied.

ii) Distinguish between normal loss and abnormal loss.

iii) How is opening work-in-progress handled in process costing ?

iv) How can the income from the sale of by-products be shown in the income statement ?

v) What is 'operating cost' ?

vi) What is 'composite unit' ? Give a list of six such units indicating the industries in which these are used.

(c) Objective type

x. i) A job cost sheet prepared on the basis of estimated cost is more useful than that prepared on the basis of actual costs.

ii) Main product of one industry can never be the by-product of another industry.

iii) Production completed and on hand in one processing department can still be treated as work-in-progress.

iv) The output of one process, which needs further processing in the next process, is to be transferred only at cost.

v) The method of costing to be used by a gas distributing company is operating costing.

y. *Fill in the blanks* :

i) The value of normal material wastage for a particular job is not to be charged to the _____ separately.

ii) The _____ Department prepares production order which acts as an authorization to start work on the job.

iii) In case of abnormal gain in process costing, _____ A/C is credited for loss of income from sale of normal loss units.

iv) The industries which render services must use _____ costing.

v) The products of insignificant value, produced simultaneously from same raw material are known as _____ .

(d) Hints for solutions *(for objective type questions)*

x. (i) True, (ii) False, (iii) True, (iv) False, (v) True.

y. (i) job, (ii) Production Control, (iii) Normal Loss, (iv) operating, (v) By-products.