

**Solution:****Working Notes:****1. Computation of time saved (in hours) per month:**

$$\begin{aligned}
 &= (\text{Standard production time of } 6,120 \text{ units} - \text{Actual time taken by the workers}) \\
 &= (6,120 \text{ units} \times 1,975 \text{ hours} - 24 \text{ days} \times 8 \text{ hrs. per day} \times 50 \text{ skilled workers}) \\
 &= (12,087 \text{ hours} - 9,600 \text{ hours}) \\
 &= 2,487 \text{ hours}
 \end{aligned}$$

**2. Computation of bonus for time saved hours under Halsey and Rowan schemes:**

$$\begin{aligned}
 \text{Time saved hours} &= 2,487 \text{ hours} \\
 \text{(Refer to Working Note 1)} & \\
 \text{Wage rate per hour} &= \text{Rs. } 30 \\
 \text{Bonus under Halsey Scheme} &= 1/2 \times 2,487 \text{ hours} \times \text{Rs. } 30 \\
 \text{(With 50\% bonus)} &= \text{Rs. } 37,305 \\
 \text{Bonus under Rowan Scheme} &= \frac{\text{Time saved}}{\text{Time allowed}} \times \text{Time taken} \times \text{Rate per hour} \\
 &= \frac{2,487 \text{ hours}}{12,087} \times 9,600 \text{ hours} \times \text{Rs. } 30 \\
 &= \text{Rs. } 59,258.38
 \end{aligned}$$

**(i) Computation of effective rate of earnings under the Halsey and Rowan Schemes:**

$$\begin{aligned}
 \text{Total earnings (under Halsey scheme)} &= \text{Time wages} + \text{Bonus} \\
 \text{(Refer to Working Note 2)} & \\
 &= 24 \text{ days} \times 8 \text{ hours} + 50 \text{ skilled} \\
 &\quad \text{workers} \times \text{Rs. } 30 + \text{Rs. } 37,305 \\
 &= \text{Rs. } 2,88,000 + \text{Rs. } 37,305 = \text{Rs. } 3,25,305 \\
 \text{Total earnings (under Rowan scheme)} &= \text{Time wages} + \text{Bonus} \\
 \text{(Refer to Working Note 2)} & \\
 &= \text{Rs. } 2,88,000 + \text{Rs. } 59,258.38 \\
 &= \text{Rs. } 3,47,258.38 \\
 \text{Effective rate of earnings per hour (under} &= \text{Rs. } 33.89 \\
 \text{Halsey Plan (Rs. } 3,25,305/9,600 \text{ hrs)} & \\
 \text{Effective rate of earnings per hour (under} &= \text{Rs. } 36.17 \\
 \text{Rowan Plan (Rs. } 3,47,258.38/9,600 \text{ hrs)} &
 \end{aligned}$$

**(ii) Savings to the ZED Ltd., in terms of direct labour cost per piece:**

	Rs.
Direct labour cost (per unit) under time wages system (1.975 hrs per unit × Rs. 30)	59.25
Direct labour cost (per unit) under Halsey Plan (Rs. 3,25,305/6,120 units)	53.15
Direct labour cost (per unit) under Rowan Plan (Rs. 3,47,258.38/6,120 units)	56.74
Saving of direct labour cost under:	
* Halsey Plan (Rs. 59.25 – 53.15)	Rs. 6.10
* Rowan Plan (Rs. 59.25 – 56.74)	Rs. 2.51

**(iii) Advise to ZED Ltd:** (about the selection of the scheme to fulfill assurance)

Halsey scheme brings more savings to the management of ZED Ltd., over the present earnings of Rs. 2,88,000 but the other scheme viz. Rowan fulfils the promise of 20% increase over the present earnings of Rs. 2,88,000 by paying 20.58% in the form of bonus. Hence Rowan Plan may be adopted.

**Example 5.7**

A job can be executed either through workman A or B. A takes 32 hours to complete the job while B finishes it in 30 hours. The standard time to finish the job is 40 hours.

The hourly wage rate is same for both the workers. In addition workman A is entitled to receive bonus according to Halsey plan (50% sharing) while B is paid bonus as per Rowan plan. The works overheads are absorbed on the job at Rs 7.50 per labour hour worked. The factory cost of the job comes to Rs. 2,600 irrespective of the workman engaged.

Find out the hourly wage rate and cost of raw materials input. Also show cost against each element of cost included in factory cost. (C.A. Inter Nov. 1997)

**Solution:***Basic Calculations*1. *Computation of Time Saved and Wages*

Workman	A	B
Standard Time (hrs.)	40	40
Actual Time (hrs.)	32	30
Time Saved (hrs.)	08	10
Wages paid @ Rs x per hr. (Rs.)	<u>32x</u>	<u>30x</u>

2. *Computation of Bonus*

	Halsey Plan	Rowan Plan
Time saved (hrs.)	8	10
Bonus (Rs.)	$\frac{8 \text{ hrs.} \times \text{Rs. } x}{2} = 4x$	$\frac{10 \text{ hrs.}}{40 \text{ hrs}} \times 30 \text{ hrs.} \times \text{Rs. } x = 7.5x$

3. *Computation of Total Wages*

Workman A:  $32x + 4x = \text{Rs. } 36x$   
 Workman B:  $30x + 7.5x = \text{Rs. } 37.5x$

4. *Computation of Factory Cost of the Job*

Workman	A	B
	Rs.	Rs.
Material	y	y
Wages (as per above)	36x	37.5x
Works Overhead	<u>240</u>	<u>225</u>
Factory Cost	<u>2,600</u>	<u>2,600</u>

From the above, the following simultaneous equation can be made out:

$$36x + y + 240 = 2,600 \quad \text{(i)}$$

$$37.5x + y + 225 = 2,600 \quad \text{(ii)}$$

On subtracting (i) from (ii) we get the following results:

$$1.5x - 15 = 0$$

or  $1.5x = 15$

or  $x = \text{Rs. } 10 \text{ per hour.}$

On substituting the value of  $x$  in Eq. (i)

$$36 \times 10 + y + 240 = 2,600$$

or  $y' = 2,600 - 360 - 240$

or  $y = \text{Rs. } 2,000$

The wage rate per hour is Rs. 10 and the cost of raw material input is Rs. 2,000 for the job.

### Example 5.16

In a factory Ram and Sham produce the same product using the same input of same material and at the same normal wage rate.

Bonus is paid to both of them in the form of normal time wage rate adjusted by the proportion which time saved bears to the standard time for the completion of the product. The time allotted to the product is fifty hours. Ram takes thirty hours and Sham takes forty hours to produce the product. The factory cost of the product for Ram is Rs. 3,100 and for Sham Rs. 3,280. The factory overhead rate is Rs. 12 per man hour.

Calculate (i) Normal Wage Rate; (ii) Cost of material used for the product; and (iii) the input of material if the unit material cost is Rs. 16. *(B.Com. (Hons.) Delhi 1997)*

*Solution* Let  $x$  be the cost of material and  $y$  be the normal rate of wages per hour

#### Factory Cost of Workman Ram

	Rs.
Material	$x$
Wages	$30y$
Bonus ( $30y \times 20/50$ )	$12y$
Overheads	$360$
Factory Cost	$x + 42y + \text{Rs } 360$

#### Factory Cost of Workman Sham

Material	$x$
Wages	$40y$
Bonus ( $40y \times 10/50$ )	$8y$
Overheads	$480$
	$x + 48y + 480$

The following two equations can be made

$$x + 42y + 360 = \text{Rs. } 3,100 \quad \text{(i)}$$

$$x + 48y + 480 = \text{Rs. } 3,280 \quad \text{(ii)}$$

On subtracting Eq. (i) from Eq. (ii)

$$6y + 120 = 180$$

or

$$6y = 180 - 120$$

$$y = 60/6 = 10$$

On substituting the value of  $y$  in Eq. (i)

$$x + 420 + 360 = 3,100$$

or

$$x = 3,100 - 780$$

or

$$x = 2,320$$

Thus:

- (i) Normal Wage Rate is Rs. 10 per hour
- (ii) Cost of material used for the product is Rs. 2,320
- (iii) Input of material is  $2,320/16 = 145$  units.

### Example 5.17

An article passes through five hand operations as follows:

Operation No.	Time per article	Grade of worker	Wage rate per hour
1	15 minutes	A	Re. 0.65
2	25 minutes	B	Re. 0.50
3	10 minutes	C	Re. 0.40
4	30 minutes	D	Re. 0.35
5	20 minutes	E	Re. 0.30

The factory works 40 hours a week and the production target is 600 dozens per week. Prepare a statement showing for each operation and in total the number of operators required, the labour cost per dozen and the total labour cost per week to produce the total targeted output. (C.A. Inter May 1996)

*Solution:* Statement of Number of Operators Required and Labour Cost

Operation No.	No. of Operators required* (see Working Note)	Labour Cost of 600 dozens per week Rs.	Labour Cost per dozen Rs.
1	45	1,170 (45 × 40 × 0.65 p)	1.95 (Rs. 1,170/600)
2	75	1,500 (75 × 40 × 0.50 p)	2.50 (Rs. 1,500/600)
3	30	480 (30 × 40 × 0.40 p)	0.80 (Rs. 480/600)
4	90	1,260 (90 × 40 × 0.35 p)	2.10 (Rs. 1,260/600)
5	60	720 (60 × 40 × 0.30 p)	1.20 (Rs. 720/600)
	300	5,130	8.55

**Working Notes:**

<i>Operation No.</i>	<i>No. of operators required</i>
1	$\frac{600 \text{ dozens} \times 12}{40} \times \frac{15}{60} = 45$
2	$\frac{600 \text{ dozens} \times 12}{40} \times \frac{25}{60} = 75$
3	$\frac{600 \text{ dozens} \times 12}{40} \times \frac{10}{60} = 30$
4	$\frac{600 \text{ dozens} \times 12}{40} \times \frac{30}{60} = 90$
5	$\frac{600 \text{ dozens} \times 12}{40} \times \frac{20}{60} = 60$

**Example 5.18**

A company has its factories at two locations. Rowan plan is in use at location *A* and Halsey plan at location *B*. Standard time and basic rate of wages are same for a job which is similar and is carried out on similar machinery. Time allowed is 60 hours.

Job at location *A* is completed in 36 hours while at *B*, it has taken 48 hours. Conversion costs at respective places are Rs. 1,224 and Rs. 1,500. Overheads account for Rs. 20 per hour.

**Required:**

- To find out the normal wage rate and
- To compare respective conversion costs.

*(C.A. Inter June 1995)***Solution:**

Let Rs  $x$  per hour be the normal wage rate

∴ Wages at location *A* will be Rs.  $36x$  and Rs.  $48x$  for location *B*.

Time allowed is 60 hours

Hence, for time saved, bonus will be payable as under

*Location A*

$$\begin{aligned} \text{Bonus under Rowan Scheme} &= \frac{\text{Time saved}}{\text{Time allowed}} \times \text{hrs worked} \times \text{Rate} \\ &= \frac{24}{60} \times 36 \times x = \text{Rs } 14.4x \end{aligned}$$

$$\text{Total wages Rs. } 36x + \text{Rs. } 14.4x = \text{Rs. } 50.4x$$

Overheads @ Rs 20 per hour worked Rs. 720

Hence, total conversion cost is  $50.4x + 720 = \text{Rs. } 1,224$  (given)

$$\text{or } x = 10.$$

*Location B*

Bonus under Halsey plan	= 50% of Time saved × Rate per hour
	= 50% of $12 \times x = \text{Rs. } 6x$
Total Wages	= $48x + \text{Rs. } 6x = \text{Rs. } 54x$
Overheads Rs. 20 per hour	= Rs. 960
Total Conversion Cost is $54x + 960$	= Rs. 1,500
or	$x = \text{Rs. } 10.$

**Comparative Conversion Cost**

<i>Particulars</i>	<i>A (Rowan)</i>	<i>B (Halsey)</i>
Wages @ Rs. 10 per hour	Rs. 360	Rs. 480
Bonus	Rs. 144	Rs. 60
Overheads	Rs. 720	Rs. 960
	Rs. 1,224	Rs. 1,500

**Example 5.19**

Following are the particulars for April, 2002 relating to four employees working in Department 'M' of a factory, exclusively for Job. No. 120.

<i>Name</i>	<i>Designation</i>	<i>Wages (Rs.)</i>	<i>Per</i>
<i>A</i>	Foreman	8000	month
<i>B</i>	Mechanic	150	day
<i>C</i>	Machine operator	120	day
<i>D</i>	Workman	100	day

The normal working hours per week of six days are 48, or 8 hours per day. Sundays are paid holidays. (There were no other holidays during the month).

Provident Fund contribution was 8% of monthly wages by employee.

Provident Fund contribution was 8% of monthly wages by employer.

Employee State Insurance Contribution was 3% of monthly wages by employee and 5% of monthly wages by employer.

From the foregoing data, calculate:

- Net wages payable by the employer for the month;
- The total amount of Provident Fund contribution to be deposited by employer;
- Employee State Insurance contribution to be deposited by employer;
- Total labour cost to the employer for the month of April, chargeable to the job; and
- The total cost of the job requiring materials is valued at Rs. 60,000 and overheads at 50% of prime cost.

(ICWA Inter)

**Solution:****(a) Calculation of Net Wages Payable for the Month**

Gross wages for April, 2002	Rs.
A Foreman (a) Rs. 8000 p.m.	8000
B Mechanic (a) Rs. 150 per day × 30 days	4500
C Machine Operator @ Rs. 120 per day × 30 days	3600
D Workman (a) Rs. 100 per day × 30 days	3000
	19100.00
<b>Less: Deductions</b>	
(i) Provident Fund Contribution @ 8% of Rs. 19100 by employees	1528
(ii) ESI Contribution @ 3% of Rs. 19100 by employees	573
	2101.00
<b>Net Wages Payable</b>	<b>16999.00</b>

(b) Employer's share of Provident Fund (8% of Rs. 19100)	Rs 1528
Employee's share of Provident Fund (8% of Rs. 19100)	1528
Total amount of Provident Fund contribution to be deposited by employer (both contributions)	3056
(c) Employer's share of ESI (5% of Rs. 19100)	955
Employee's share of ESI (3% of Rs. 19100)	573
ESI contribution to be deposited by employer (both contributions)	1528
(d) Total labour cost to employer	
Total gross wage	19100
Add: Employer's contribution towards P.F.	1528
Employer's contribution towards ESI	955
	21583
(e) Total cost of job	
Material	Rs. 60,000
Labour cost as per (d) above	21,583
Prime cost	81,583
Overheads at 50% of Prime cost	40791
Total cost of the job	1,22,374

**Example 5.20**

During audit of accounts of G. Company, your assistant found errors in the calculation of the wages of factory workers and he wants you to verify his work.

He has extracted the following information:

- (i) The contract provides that the minimum wage for a worker is his base rate. It is also paid for downtimes (that is, the machine is under repair or the worker is without work). The standard work week is 40 hours. For overtime production, workers are paid 150 percent of base rates.
- (ii) Straight Piece Work—The worker is paid at the rate of 20 paise per piece.

- (iii) Percentage Bonus Plan—Standard quantities of production per hour are established by the engineering department. The workers' average hourly production, determined from his total hours worked and his production, is divided by the standard quantity of production to determine his efficiency ratio. The efficiency ratio is then applied to his base rate to determine his hourly earnings for the period.
- (iv) Emerson Efficiency Plan—A minimum wages is paid for production upto  $66\frac{2}{3}\%$  of standard output or efficiency. When the workers production exceeds  $66\frac{2}{3}\%$  of the standard output he is paid bonus as per the following table:

Efficiency Level	Bonus
Upto $66\frac{2}{3}\%$	Nil
Above $66\frac{2}{3}\%$ to 79%	10%
80% – 99%	20%
100% – 125%	45%

Your assistant has produced the following schedule pertaining to certain workers of a weekly pay roll:

Workers	Wage Incentive Plan	Total Hours	Down Time Hours	Units Produced	Standard Units	Base Rate (Rs.)	Gross Wages as per Book (Rs.)
Rajesh	Straight piece work	40	5	400	—	1.80	85
Mohan*	Straight piece work	46	—	455	—	1.80	95
John	Straight piece work	44	—	425	—	1.80	85
Harish	Percentage bonus plan	40	4	250	200	2.20	120
Mahesh	Emerson	40	—	240	300	2.10	93
Anil	Emerson (40 hours production)	40	—	600	500	2.00	126

\* Total hours of Mohan include 6 overtime hours.

Prepare a schedule showing whether the above computation of workers' wages are correct or not. Give details.  
(C.A. Inter May 1999)

**Solution:**

**Minimum Wages  
(Gross Wages and Wages to be paid)**

Workers	Wage Incentive Plan	Minimum Wages (Rs.)	Gross Wages computed as per incentive Plan (Rs.)	Gross Wages as per book (Rs.)	Wages to be paid (Rs.)
Rajesh (WN 1)	Straight piece work	72.00	80.00	85	80.00
Mohan (WN 2)	Straight piece work	88.20	91.00	95	91.00
John (WN 3)	Straight piece work	82.80	85.00	85	85.00
Harish (WN 4)	Percentage bonus plan	88.00	110.00	120	110.00
Mahesh (WN 5)	Emerson	84.00	100.80	93	100.80
Anil (WN 6)	Emerson	80.00	116.00	126	116.00



**Working Notes:**

1. Minimum Wages for Rajesh = Total Normal Hours × Rate per Hour  
= 40 hours × Rs. 1.80 = Rs. 72
- Gross wages (Computed) = No. of units × Rate per unit  
as per incentive plan = 400 units × Rs. 0.20 = Rs. 80
2. Minimum Wages for Mohan = Total Normal Hours × Rate per Hour  
+ Overtime Hours × Overtime Rate per Hour  
= 40 hours × Rs. 1.80 + 6 hours × Rs. 2.70  
= Rs. 72 + Rs. 16.20 = Rs. 88.20
- Gross wages (computed) = 455 units × Rs. 0.20 = Rs. 91.00  
as per incentive plan
3. Minimum Wages for John = 40 hours × Rs. 1.80 + 4 hours × Rs. 2.70  
= Rs. 72 + Rs. 10.80 = Rs. 82.80
- Gross Wages (computed) = 425 units × Rs 0.20 = Rs. 85  
as per incentive plan
4. Minimum Wages for Harish = 40 hours × Rs. 2.20 = Rs. 88
- Efficiency of Worker =  $\frac{\text{Actual Production per hour}}{\text{Standard Production per hour}} \times 100$   
=  $\frac{(250 \text{ units}/40 \text{ hours})}{(200 \text{ units}/40 \text{ hours})} \times 100 = 125\%$
- Hourly rate = Rate per hour × Efficiency of worker  
Gross Wages Computed = Rs. 2.20 × 125% = Rs. 2.75  
(as per percentage bonus plan) = 40 hours × Rs. 2.75 = Rs. 110
5. Minimum wages for Mahesh = 40 hours × Rs. 2.10 = Rs. 84
- Efficiency of worker =  $\frac{(240 \text{ units}/40 \text{ hours})}{(300 \text{ units}/40 \text{ hours})} \times 100 = 80\%$
- Bonus (as per Emerson's plan) = Total Minimum Wages × Bonus Percentage  
= Rs. 84 × 20% = Rs. 16.80
- Gross Wages as per Emerson's Efficiency plan = Minimum wages + Bonus  
= Rs. 84 + Rs. 16.80 = Rs. 100.80
6. Minimum Wages for Anil = 40 hours × Rs. 2 = Rs. 80
- Efficiency of worker =  $\frac{600}{500} \times 100 = 120\%$
- Bonus as per Emerson's plan = Rs. 80 × 45% = Rs. 36  
Gross wages as per Emerson's Efficiency plan = Rs. 80 + Rs. 36 = Rs. 116

**Example 5.21**

The Cost Accountant of Tirupati Electronics Ltd. has computed labour turnover rates for the quarter ending 31st March, 1998 as 10%, 5% and 3% respectively under 'Flux Method', Replacement Method', and 'Separation Method'. If the number of workers replaced during that quarter is 30, find out the number of (a) workers recruited and joined and (b) workers left and discharged.

(B. Com.(Hons). Delhi 1998, 2006)

*Solution Computation of Labour Turnover Rate*

$$\begin{aligned} 1. \text{ Replacement Method} &= \frac{\text{Number of replacements}}{\text{Average number of workers}} \\ &= \text{Putting the values in formula} \end{aligned}$$

$$\frac{5}{100} = \frac{30}{\text{Av. No. of workers}}$$

$$\text{Hence, average number of workers} = \frac{30 \times 100}{5} = 600$$

2. Separation Method

$$\frac{\text{No. of separations}}{\text{Average number of workers}}$$

$$\text{or} \quad = \frac{3}{100} = \frac{X}{600}$$

$$X = 18$$

3. Flux Method

$$= \frac{\text{Number of separations} + \text{Number of additions}}{\text{Average number of workers}}$$

$$= \frac{10}{100} = \frac{18 + \text{No. of additions}}{600}$$

$$= \text{No. of additions} = \frac{600 - 1800}{100} = \frac{4200}{100}$$

$$= 42$$

$$\text{Hence, the number of Additions} = 42$$

From the above, the following information as desired by the question can be computed.

- (a) Workers recruited and joined = 42  
 (b) Workers left and discharged = 18

### **Example 5.22**

The following information relates to work force in a factory during the year 2001–02:

Number of workers on April 1, 2001	2,350
Number of workers on March 31, 2002	2,850
Number of workers who quit on their own	200
Number of workers who availed golden Handshake opportunity	100
Number of workers employed during 2001–2002 including those employed due to expansion	800

Calculate annual labour turnover rate and equivalent monthly turnover rate under different methods.

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

**Solution:**

According to Separation Method:

Annual Labour Turnover Ratio

$$= \frac{\text{No. of separations during the year}}{\text{Average No. of worker}} \times 100$$

$$= \frac{200 + 100}{\frac{2350 + 2850}{2}} \times 100 = 11.54\%$$

Equivalent monthly rate

$$= \frac{\text{Annual Labour Turnover Rate}}{12}$$

$$\frac{11.54}{12} = .96\%$$

**2. According to Replacement Method:****Annual Labour Turnover Ratio**

$$= \frac{\text{Actual No. of Replacement}}{\text{Average No. of workers}} \times 100$$

$$= \frac{100}{2600} \times 100 = \frac{100}{26} = 3.85\%$$

$$\text{Equivalent monthly turnover rate} = \frac{\text{Annual labour turnover rate}}{12}$$

$$= \frac{3.85}{12} = .32\%$$

**3. According to Flux Method:****Annual Labour Turnover Rate**

$$= \frac{\text{No. of separations} + \text{No. of Replacements}}{\text{Average No. of workers}}$$

$$= \frac{400}{2600} \times 100 = 15.39\%$$

$$\text{Equivalent monthly Labour Turnover Rate} = \frac{15.39}{12} = 1.28\%$$

**Example 5.23**

The management of Sunshine Ltd. wants to have an idea of the profit lost/foregone as a result of labour turnover last year.

Last year sales amounted to Rs. 66,00,000 and the *P/V* Ratio was 20%. The total number of actual hours worked by the direct labour force was 3.45 lakhs. As a result of the delays by the personnel department in filling vacancies due to labour turnover, 75,000 potentially productive hours were lost. The actual direct labour hours included 30,000 hours attributable to training new recruits, out of which half of the hours were unproductive. The costs incurred consequent on labour turnover revealed an analysis of the following:

	Rs.
Settlement cost due to leaving	27,420
Recruitment costs	18,725
Selection costs	12,750
Training costs	16,105

Assuming that the potential production lost due to labour turnover could have been sold at prevailing prices, ascertain the profit foregone/lost last year on account of labour turnover. (C.A. Inter May 1998)

**Solution:***Basic Calculations*

- |                                       |   |
|---------------------------------------|---|
| (i) Actual Productive Hours           | = Actual hrs. Worked – Unproductive Training hrs.<br>= 3,45,000 hrs. – 15,000 hrs. = 3,30,000 |
| (ii) Sales per Productive Hour        | = Total Sales/Actual Productive hrs.<br>= Rs. 66,00,000/3,30,000 hrs. = Rs. 20                |
| (iii) Potential Productive Hours Lost | = 75,000 hrs.   |
| (iv) Sales Foregone                   | = 75,000 hrs. × Rs. 20 = Rs. 15,00,000  |
| (v) Contribution Foregone             | = Sales Foregone × <i>P/V</i> Ratio<br>= Rs. 15,00,000 × 20% = Rs. 3,00,000                   |

**M/s Sunshine Ltd.****Statement of Profit Foregone as a Result of Labour Turnover**

	Rs.
Contribution Foregone (See note (v) above)	3,00,000
Add: Settlement Cost due to leaving	27,420
Recruitment Costs	18,725
Selection Costs	12,750
Training Costs	16,105
	75,000
Total Profit Foregone	3,75,000

**Example 5.24**

From the following information calculate Labour turnover rate:

No. of workers as on 01.01.2000 = 7,600

No. of workers as on 31.12.2000 = 8,400

During the year, 80 workers left while 320 workers were discharged. 1,500 workers were recruited during the year of these, 300 workers were recruited because of exits and the rest were recruited in accordance with expansion plans. (C.A. Inter May 2001)

**Solution:**

*Labour turnover rate:*

It comprises of computation of labour turnover by using following methods:

(i) *Separation Method:*

$$\begin{aligned}
 &= \frac{\text{No. of workers left} + \text{No. of workers discharged}}{\text{Average number of workers}} \times 100 \\
 &= \frac{(80 + 320)}{(7,600 + 8,400) \div 2} \times 100 \\
 &= \frac{400}{8,000} \times 100 = 5\%
 \end{aligned}$$

(ii) *Replacement Method:*

$$\begin{aligned}
 &= \frac{\text{No. of workers replaced}}{\text{Average number of workers}} \times 100 \\
 &= \frac{300}{8,000} \times 100 = 3.75\%
 \end{aligned}$$

(iii) *New Recruitment:*

$$\begin{aligned}
 &= \frac{\text{No. of workers newly recruited}}{\text{Average number of workers}} \times 100 \\
 &= \frac{1,200}{8,000} \times 100 = 15\%
 \end{aligned}$$

*Flux Method:*

$$\begin{aligned}
 &= \frac{\text{No. of separations} + \text{No. of workers recruited}}{\text{Average number of workers}} \times 100 \\
 &= \frac{(400 + 1500)}{(7,600 + 8,400) \div 2} \times 100 \\
 &= \frac{1,900}{8,000} \times 100 = 23.75\%
 \end{aligned}$$

**Example 5.25**

The capacity usage ratio and the capacity utilisation ratio in respect of a machine for a particular month is 80% and 90% respectively. The available working hours in a month is 200 hours.

The break-up of idle-time is as follows:

Waiting for job	5 hours
Breakdown	4 hours
Waiting for tools	3 hours

Calculate the idle-time cost and present the same in a tabular form when the hourly fixed cost of running the machine is Rs. 8.00. (ICWA, Inter)

**Solution:**

Total available working hours		200 hours
Standard capacity usage	$0.80 \times 200$	160 hours
Normal (unavoidable) idle-time	$(200 - 160)$	40 hours
Actual hours worked	$0.90 \times 160$	144 hours
Abnormal idle capacity	$(160 - 144)$	16 hours
Available idle-time	$(16 - 12)$	4 hours

**Idle-time Report**

Particulars	Hours	Amount	
Normal idle-time	40	Rs. $8 \times 40$	Rs. 320
Abnormal idle-time:			
Waiting for job	5	Rs. $8 \times 5$	Rs. 40
Breakdown	4	Rs. $8 \times 4$	32
Waiting for tools	3	Rs. $8 \times 3$	24
Avoidable	4	Rs. $8 \times 4$	32
			Rs. 128
Total	56		Rs. 448

**Example 5.26**

The profitability position of TARGET LTD. for the year ending 31.03.2006 is as under.

	(Rs. in lakhs)	(Rs. in lakhs)
Annual Turnover		200
Variable Costs:		
Direct Material	60	
Direct Labour	40	
Variable Overheads	50	
Marginal Contribution		50
Fixed Overheads		10
Profit		40

The profit for the year did not match with company's expectation and works management attributed it to labour turnover.

Analysis of the data revealed the following:

Permanent workmen worked during the year	960,000 Direct labour hours
Apprentice workmen worked	80,000 Direct labour hours
	<u>1,040,000 Direct labour hours</u>

The effectiveness of direct labour hours put in by apprentice workmen was 50% and delay in replacing against separations during the year resulted in loss of 20,000 Direct labour hours.

You are required to calculate the loss of profit on account of loss of production from Labour turnover.

(I.C.W.A., Inter, Stage 1, June 2006)

**Solution:**

Effective direct labour hours:

Permanent workmen	9,60,000 hours
Apprentice workmen 50% of 80,000 hrs	40,000 hours
	<u>Total 10,00,000 hours</u>

Sales per direct labour hour = Rs. 200 lakhs ÷ 10,00,000  
= Rs. 20

Loss of production hours:

For replacement	20,000 hours
For apprentices	40,000 hours
	<u>Total 60,000 hours</u>

= 60,000 hrs × Rs. 20 = Rs. 12,00,000  
= Rs. (200 + 12) Lakhs = Rs. 212 lakhs  
= (Rs. 40 lakhs/10,40,000 hrs) × 20,000 = Rs. 76,923

Materials and Variable OH for extra 12 lakhs of Sales:

Rs. (110 lakhs/200 lakhs) × 12 lakhs = Rs. 6,60,000

**Potential Profit with no Labour Turnover**

		Rs.
Sales		<u>2,12,00,000</u>
Less Variable Costs:		
Direct labour Rs. (40,00,000) + 76,923)		40,76,923
Direct materials and variable OHs		1,16,60,000
Rs. (1,10,00,000 + 6,60,000)		
	Total	<u>1,57,36,923</u>
Contribution		54,63,077
Less: Fixed Costs		10,00,000
Potential profit		44,63,077
Actual profit		40,00,000
Loss of profit due to labour Turnover		<u>4,63,077</u>
Alternatively:		Rs.
Loss of potential Sales		12,00,000
Less: Variable Costs		
Direct labour costs	76,923	
Materials and Variable Overheads	<u>6,60,000</u>	7,36,923
Contribution Loss for Labour Turnover:		<u>4,63,077</u>

**Example 5.27**

Sona Corporation has filed the following income statement for the year ending 31<sup>st</sup> March, 2003.

Particulars	Rs.	Rs.
Sales		24,00,000
Less variable costs:		
Material	6,01,000	
Direct labour	5,19,000	
Variable factory overheads	3,20,000	
Variable selling and distribution overheads	<u>1,90,000</u>	<u>16,30,000</u>
Contribution		7,70,000
Less fixed overheads		<u>5,30,000</u>
Net income before tax		2,40,000
Capital employed		<u>12,00,000</u>

The actual number of hours direct labour worked, in the year under review is 2,06,000. As a consequence of delays in filling vacancies of employees who quit, 6,000 potential direct hours were not worked, and the actual hours worked were 4,000 hours of trainees, half the time of which was unproductive. The costs incurred in consequence of re-employment were as follows: (a) Separation costs Rs. 25,630; (b) Selection costs Rs. 32,080; (c) Recruitment costs Rs. 23,140 and (d) Training costs Rs. 31,160.

Calculate the profit foregone on account of labour turnover (round off to the nearest rupee) and the potential return on capital and sales and turnover ratio. (ICWA, Final)

**Solution:****Determination of Contribution Foregone**

	Rs.
Actual labour hours worked	2,06,000
Less unproductive training hours (50% of 4,000)	<u>2,000</u>
Actual productive hours	2,04,000
Potential labour hours not worked	6,000
Add unproductive training hours	<u>2,000</u>
Effective labour hours lost	8,000
Contribution lost Rs. $7,70,000 \times 8,000/2,04,000 =$ Rs. 30,196	

**Saving in Cost**

	Rs.
Separation costs	25,630
Selection costs	32,080
Recruitment costs	23,140
Training costs	<u>31,160</u>
	<u>1,12,010</u>



## Profit Foregone and other Ratios

		Rs.
Contribution lost	Rs.	30,196
Savings in cost		1,12,010
Total profit foregone	Rs.	1,42,206
Net profit before tax	Rs.	2,40,000
Profit foregone		1,42,206
Potential profit	Rs.	3,82,206
Actual sales	Rs.	24,00,000
Sales foregone $24,00,000 \times 8,000/2,04,000$		94,118
Potential sales	Rs.	24,94,118
Actual labour hours worked		2,04,000
Labour hours lost		8,000
Potential labour hours		2,12,000
Potential profit on capital employed:		3,82,206/12,00,000 = 31.851%
Potential profit on potential sales:		3,82,206/24,94,118 = 15.324%
Turnover ratio = labour hour lost/potential labour hours		= 8,000/2,12,000 = 3.774%

## THEORY QUESTIONS

- Describe the various methods of recording time. *(B. Com. (Hons), Delhi, 2007)*
- What are the merits and demerits of time rate and piece-rate systems of wage payment? State the situations in which each system is effective and useful. *(CA Inter)*
- What are the reasons for booking workers on idle time in a factory? How is idle time controlled and treated in cost accounts? *(CA Inter)*
- Discuss individual bonus systems, group bonus systems and bonus systems for indirect workers.
- List the characteristics desirable in any Incentive Wages Plan.
- Distinguish between systems of wage payments known as Taylor's Differential Piece-Rate and Emerson's Efficiency system.
- What is labour turnover? How will you measure it? What are its causes and effects on labour costs? *(CA Inter, ICWA Inter)*
- What is idle time? Indicate the different categories into which idle time can be classified and state which of them can be effectively controlled and how? *(ICWA Inter)*
- A company is considering installing a workers' profit sharing scheme in lieu of an individual bonus scheme. You are required to specify the disadvantages of the former. *(ICWA Inter)*
- (a) Describe the treatment of payments to labour for overtime work and in respect of holiday with pay in cost accounts. *(B. Com., Delhi)*  
(b) Distinguish between Taylor's differential piece-rate and the Emerson Efficiency Plan system of incentive wage payments. *(B. Com. Delhi)*
- For each of the pay roll costs given below, state the accounting treatment that you would recommend, giving your reason:  
(a) Idle time in the finishing department because the assembly department delayed its production.

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- (b) Overtime resulting from a customer saying "I want this job done in a week, and if you have to work overtime, I do not mind".
- (c) Labour time involved in reworking 5 units out of a batch of 50, on a process where 10% of the completed units are expected to be defective. *(B. Com. (Hons), Delhi, 2002)*
12. Discuss labour turnover and different methods of measuring it. *(B. Com. (Hons), Delhi, 2005)*
13. What do you mean by labour turnover? What are the costs associated with it? How would you treat these costs in cost accounting? *(B. Com. (Hons), Delhi, 2006, 2007, I.C.W.A. Inter, Stage I, June 2006)*
14. Under the Rowan Premium Bonus system, a less efficient worker can obtain same bonus as a highly efficient worker. Discuss with suitable example. *(CA, PE, Exam II, Group II, May 2007)*
15. Discuss the effect of overtime payment on productivity. *(CA, PE, Exam II, Group II, Nov. 2004)*
16. Explain the purpose of time keeping and time booking and state what detailed records are normally maintained under each. Do you feel any need for reconciliation of these two? What is the benefit you expect if such reconciliation is carried out? *(ICWA Inter)*
17. Write a short essay on "Time and Motion Study", stating the benefits to be derived by management from such study. *(ICWA Inter)*
18. How are payments to workers in respect of overtime work and set-up time treated in cost accounts? *(CA, PE, Exam. II, Group II, Nov. 2004)*
19. What is idle time? Explain the causes leading to idle time and its treatment in cost accounts. *(B. Com. (Hons), Delhi 2004)(B. Com., Delhi 2003, 2007)*
20. Explain the nature and significance of 'Labour Turnover'. *(B. Com. (Hons) Delhi 1999)*
21. What are the effects of labour turnover on cost of production? *(B. Com. (Hons), Delhi 2000)*
22. Enumerate the causes of labour turnover. What is the impact of high labour turnover on the cost of production? *(B. Com. (Hons), Delhi 2001)*
23. "High wages do not necessarily mean high labour cost". Elucidate. *(ICWA Inter)*
24. How is payroll accounting function organised in a manufacturing establishment? *(B. Com. (Hons), Delhi)*
25. Explain what is meant by group bonus and state the objectives of introducing a group bonus schemes. *(CA Inter)*
26. What do you understand by overtime premium? What is the effect of overtime payment on productivity and cost? Discuss the treatment of overtime premium in cost accounts and suggest a procedure for control of overtime. *(B. Com. (Hons), Delhi 2004)*
27. What do you understand by time and motion study? Explain how standard time is set under time study. State how time and motion study is useful to management. *(CA Inter)*
28. Define job evaluation and distinguish it from merit rating. Explain the method and objectives of job evaluation. *(CA Inter)*
29. What do you understand by 'idle time'? Distinguish between 'Normal' and 'Abnormal idle time'. How would you deal with each one of them in cost accounts? Give a suitable example to clarify your answer. *(B. Com. (Hons), Delhi 2005, 2007, B. Com. Delhi 2002)*
30. How will you treat the following in cost accounts:
- (i) Interest on capital
  - (ii) Leave wages
  - (iii) Research and development cost
  - (iv) Audit fees *(B. Com. (Hons), Delhi)*
31. State the circumstances in which time rate system of wage payment can be preferred in a factory. *(CA, PE, Exam II, Group II, Nov. 2004)*
32. Discuss briefly how will you deal with casual workers and workers employed on outdoor work in cost accounts. *(CA, PE, Exam II, Group II, May 2002)*

**PROBLEMS**

1. There are two piece-workers, Rakhhal and Upendra, who are paid Rs. 5 for each piece work executed, which costs Rs. 15 per piece in materials.

In a working day of 8 hours, Rakhhal can complete 4 pieces and Upendra only 3. If the overhead charges be Rs. 1.50 per hour show which of the two piece workers is more useful to the factory. *(ICWA Inter)*

*Ans:* Rakhhal's cost of production is Rs. 23 per unit. Upendra's cost of production is Rs. 24 per unit. Rakhhal's employment will be useful as his cost is lesser than that of Upendra's cost.

2. The standard hours of job X is 100 hours. The job has been completed by Amar in 60 hours, Akbar in 70 hours and Anthony in 95 hours. The bonus system applicable to the job is as follows:

<i>Percentage of time saved to time allowed</i>	<i>Bonus</i>
Saving upto 10%	10% of time saved
From 11% to 20%	15% of time saved
From 21% to 40%	20% of time saved
From 41% to 100%	25% of time saved

The rate of pay is Rs. 10 per hour. Calculate the total earnings of each worker and also the rate of earnings per hour. *(CA. Inter year.)*

*Ans:* Amar Rs. 11.33, Akbar Rs. 10.857, Anthony Rs. 10.052

3. Calculate total monthly remuneration of three workers A, B and C from the following data:

(a) Standard production per month per worker – 1,000 units. Actual production during month A–850 units, B–750 units, C–950 units.

(b) Piecework rate Rs. 10 per unit (actual production).

(c) Additional production bonus is Rs. 10 for each percentage or actual production exceeding 80%. *(ICWA Inter.)*

(d) Dearness pay fixed Rs. 50 per month.

*Ans:* A—Rs. 8,600, B—Rs. 7,550, C—Rs. 9,700

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

(i) Basic wages/piece work wages @ Rs. 2 per unit subject to a guaranteed minimum wages of Rs. 60 per day.

(ii) Dearness allowance at Rs. 40 per day.

(iii) Incentive bonus:

Standard output per day per worker: 40 units;

Incentive bonus up to 80% efficiency: Nil;

Incentive bonus for efficiency above 80%: Rs. 50 for every 1% increase above 80%.

The details of performance of four workers for the month of April 1998 are as follows:

<i>Worker</i>	<i>No. of days worked</i>	<i>Output (units)</i>
<i>A</i>	25	820
<i>B</i>	18	500
<i>C</i>	25	910
<i>D</i>	24	780

Calculate the total earnings of each of the workers. *(I.C.W.A. Inter Dec. 1998)*

*Ans:* Total earnings A—Rs. 2,740, B—Rs. 1,800, C—Rs. 3,370, D—Rs. 2,570

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

*(C.A. Inter 1995)*

*Ans:* Earnings under Halsey scheme Rs. 94.50  
Earnings under Rowan scheme Rs. 101.25

6. Calculate the earnings of workers *A*, *B* and *C* under Straight Piece Rate System and Merrick's Multiple Piece Rate System from the following particulars:

Normal Rate per Hour	Rs. 5.40
Standard Time per Unit	1 Minute

Output per day is as follows:

Worker <i>A</i> —390 Units
Worker <i>B</i> —450 Units
Worker <i>C</i> —600 Units

(C.A. Inter May 1998)

Working hours per day are 8.

	Straight Piece Rate	<i>Ans:</i> Earnings under Merrick's Piece Rate
<i>A</i>	Rs. 35.10	Rs. 35.10
<i>B</i>	40.50	44.50
<i>C</i>	54.00	64.80

7. A worker, whose day-work wages are Rs. 25 per hour, received production bonus under the Rowan Scheme. He carried out the following work in a 48-hour week:

Job 1—1,500 items at 4 hours per 1,000

Job 2—1,800 items at 3 hours per 1,000

Job 3—9,000 items at 6 hours per 1,000

Job 4—1,500 items for which no 'standard time' was fixed and it was arranged that the worker would be paid a bonus time of 25 per cent. Actual time on the job was 4 hours.

Job 5—2,000 items at 8 hours per 1,000, this job was estimated to be half-finished.

Job No. 2 was carried out on a machine running at 90 per cent efficiency and an extra allowance of 1/9th of actual time was given to compensate the worker.

4 hours were lost due to power cut. Calculate the earnings of the worker, clearly stating your assumptions for the treatment given by you for the hours lost due to power-cut.

(ICWA Inter)

*Ans:* Rs. 1,687.34

8. Following particulars have been extracted from the books of Supreme Engineers Limited:

Time allowed for the job	15 hrs	15 hrs	15 hrs
Time taken	15 hrs	12 hrs	9 hrs
Bonus ratio for Halsey	50%		
Rate per hour	Rs. 2		

- (a) You are required to compute the quantum of wages under Halsey Scheme and Rowan Schemes. Which of these schemes would you like to introduce in this company if the time taken to complete the job is likely to reduce to 6 hours after three months?
- (b) An alternative method of payment by result is by a straight piece work rate for completion of the job in 7 hours is feasible. Would you like to switch over to this method of payment given further that hourly rate would be reckoned at Rs. 1.50 for fixation of the piece rate? Please give reasons for your advice. (ICWA, Inter)

*Ans:*

Time taken	Wages Halsey	Wages Rowan
	Rs.	Rs.
15	30	30
12	27	28.80
9	24	25.20
6	21	19.20

9. The management of Bina and Rina Ltd. is worried about its increasing labour turnover in the factory and before analysing the causes and taking remedial steps it wants to have an idea of the profit foregone as a result of labour turnover in the last year.

Last year sales amounted to Rs. 83,03,300 and P/V ratio was 20 per cent. The total number of actual hours worked by the direct labour force were 4.45 lakhs. As a result of the delays by the personnel department in filling vacancies due to labour turnover, 1,00,000 potentially productive hours were lost. The actual direct labour hours included 30,000 hours attributable to training new recruits, out of which half of the hours were unproductive. The cost incurred consequent on labour turnover revealed, on analysis, the following:

Settlement cost due to leaving	Rs. 43,820
Recruitment costs	Rs. 26,740
Selection costs	Rs. 12,750
Training costs	Rs. 30,490

Assuming that the potential production lost as a consequence of labour turnover could have been sold at prevailing prices, find the profit fore gone last year on account of labour turnover.

(CA. Inter Nov. 2001, CA, PE, Exam II, Group II, Nov. 2004)  
 Ans: Profit foregone Rs. 5,00,000.

10. A company's basic wage rate is Rs. 3.00 per hour and its overtime rates are:

Evenings	Time and one-third
Weekends	Double time

During the previous year the following hours were worked:

	Hours
Normal time	2,20,000
Time plus one-third	20,000
Double time	10,000

The following times have been worked on these jobs:

	Job-A Clock hours	Job-B Clock hours	Job-C Clock hours
Normal time	3,000	5,000	4,000
Evening overtime	300	600	1,050
Weekend overtime	100	50	300
Total	<u>3,400</u>	<u>5,650</u>	<u>5,350</u>

You are required to calculate the labour cost chargeable to each job where overtime is worked regularly throughout the year as the company policy due to labour shortage.

Ans: Job A Rs. 10,880; Job B Rs. 18080;  
 Job C Rs. 17,120.

11. The following particulars for the first week of September 2003 relate to X and Y, two workers employed in a factory.

	X	Y
(a) Job completed (units)	3,600	4,200
(b) Out of above, output rejected and unsaleable	540	420
(c) Time allowed	12 minutes per dozen	3 hours for 200 units
(d) Basic wages rate per hour	Rs. 5	Rs. 6
(e) Hours worked	45	50

The normal working hours per week are fixed at 42 hours. Bonus is paid @ 2/3 of basic wage rate for gross time worked and gross output produced without deduction of rejected output. The rate of overtime for first 4 hours is paid at time plus 1/3 and next 4 hours is paid at time plus 1/2.

From the above data, calculate for each employee:

- (a) Number of bonus hours earned and amount of bonus earned.
- (b) Total wages earned including basic wages, overtime premium and bonus.
- (c) Direct wages cost per 100 saleable units.

(ICWA, Inter)

Ans: (a)

	Worker	
	X	Y
Bonus earned	Rs. 50	Rs. 52
Total Wages	280	372
Direct Wages	Rs. 7.78	Rs. 8.86

12. Both direct and indirect labour of a department in a factory are entitled to production bonus in accordance with a group incentive scheme, the outline of which is as follows:

- (a) For any production in excess of the standard rate fixed at 10,000 units per month (of 25 days) a general incentive of Rs. 10 per unit is paid in aggregate. The total amount payable to each separate group is determined on the basis of an assumed percentage of such excess production being contributed by it, namely @ 70% by direct labour, @ 10% by inspection staff, @ 12% by maintenance staff and @ 8% by supervisory staff.
- (b) Moreover, if the excess production is more than 20 per cent above the standard, direct labours also get a special bonus @ Rs. 5 per unit for all production in excess of 120% of standard.
- (c) Inspection staff are penalised @ Rs. 20 per unit for rejection by customer in excess of 1% of production.
- (d) Maintenance staff are also penalised @ Rs. 20 per hour of breakdown.

From the following particulars for a month, work out the production bonus earned by each group:

- (a) Actual working days: 20  
 (b) Production: 11,000 units  
 (c) Rejection by customer: 200 units  
 (d) Machine breakdown: 40 hours.

(ICWA, Inter)

Ans: Direct labour Rs. 28,000;

Inspection staff Rs. 1,200; Maintenance staff Rs. 2,800; supervisory staff Rs. 2,400.

13. In a unit, 10 men work as a group. When the production of the group exceeds the standard output of 200 pieces per hour, each man is paid an incentive for the excess production in addition to his wages at hourly rates. The incentive is at half of the percentage of the excess production over the standard production. Each man is paid incentive at the rate of this percentage of wage rate of Rs. 2 per hour. There is no relation between the individual workman's hourly rate and the bonus rate.

In a week, the hours worked are 500 hours and the total production is 1,20,000 pieces.

- (a) Compute the total amount of the bonus for the week.  
 (b) Calculate the total earnings of two workers A and B of the group:  
 A worked 44 hours and his basic rate per hour was Rs. 2.20  
 B worked 48 hours and his basic rate per hour was Rs. 1.90

(CA, Inter)

Ans: Total earnings A Rs. 105, B Rs. 100.80

14. Calculate normal overtime and total wages payable to a worker from the particulars given below:

Days	Hours worked	
Monday	10	Normal working hours = 8 per day; Saturdays: 4 per day Normal rate = Rs. 5 per day Overtime rate = upto 9 hours per day, single rate, and beyond 9 hours a day, double rate.
Tuesday	9	
Wednesday	8	
Thursday	12	
Friday	9	
Saturday	4	

(ICWA, Inter)

Ans: Total wages Rs. 280.

15. The time taken for a particular operation for Operator X in the process division of a manufacturing concern on three different counts was 24, 22 and 27 minutes while that of Operator Y was 20, 23 and 26 minutes. It has been ascertained that the rating of X is 70/60 and that of Y is 55/60. Allowances for fatigue, and personal needs are assumed at 15%. Calculate, using the above information as a base for that particular operation,

- (i) the standard time  
 (ii) the time allowed under an incentive allowance of 30% of standard time.

(ICWA, Inter)

Ans: Standard time 28.448 minutes  
 Time allowed 36.982 minutes.

## **F**ACTORY OVERHEADS: DISTRIBUTION

### **Learning Objectives:**

After reading this chapter, you should be able to:

1. explain factory overheads—concepts, its classification, nature, its collection and codification, its allocation and apportionment, its accounting and distribution;
2. discuss different methods of absorption of factory overheads and merits and demerits of apportionment and absorption of overheads; and
3. explain actual overhead rate, predetermined overhead rate, under- or over-absorption of overhead.

### **CONCEPT**

Factory overhead costs are operating costs of a business enterprise which cannot be traced directly to a particular unit of output, that is, product or jobs. Factory overhead is the aggregate of indirect materials, indirect wages and indirect expenses. The term “overhead” is used interchangeably with such terms as “burden”, “supplementary costs”, “indirect expense”, “factory expense”. The word “overhead” is more appropriate than burden and supplementary costs because the latter terms imply an unnecessary charge, an extra cost or an element of cost resulting from inefficiency. The term “overhead” is preferable to manufacturing expenses, because manufacturing expenses often refer to all manufacturing costs, both direct and indirect. Overhead may be used for all types of business enterprises while manufacturing expense is restricted in its use to manufacturing concerns.

### **FACTORY OVERHEAD—FIXED, SEMI-VARIABLE AND VARIABLE**

Factory Overhead costs can be divided into fixed, semi-variable and variable costs. Fixed overhead costs are commonly described as those that do not vary in total amount with increases or decreases in productive activity or volume of output for a given period of time, usually, a year. Management salaries, building depreciation, rent, property taxes and amortisation of leaseholds are some examples of fixed overhead. Fixed costs are constant in total amount, but vary per unit as production activity changes.

Semi-variable or semi-fixed are those which remain fixed in total amount over a relatively short range of variation in output and then are abruptly changed to a new level, where they remain fixed in total amount for another short range of output. For example, if a third shift is added without increasing plant facilities,

normally fixed costs, such as supervision salaries may increase because of the necessity of night supervision, insurance premiums may be raised because of additional fire, theft, and accident risk, and some equipment rentals may be accelerated.

Variable costs include repairs, powers, workmen's compensation, supplies and indirect labour which are typical of cost varying in total amount, with changes in productive activity. The increase or decrease in variable overhead costs need not be in the same proportion to the change in output. However, in many cases there is a directly proportional relationship. Variable costs per unit remain relatively constant with changes in production. Thus, variable costs fluctuate in total amount but tend to remain constant per unit as production activity changes. Variable overheads are generally considered controllable as they directly relate to the volume of output and by reducing the level of activity they can be reduced/avoided. Also, by comparing the actual variable overheads with budgeted variable overheads, such overheads can be controlled and kept within targets and tolerance limits.

## **FACTORY OVERHEADS—ACCOUNTING AND DISTRIBUTION**

Factory Overheads by nature cannot be identified or associated directly with specific products or jobs. However, they should be included in total cost of products or jobs. The following steps are important in distribution of overhead costs among products or jobs.

1. Collection and codification
2. Allocation and apportionment
3. Absorption

## **COLLECTION AND CODIFICATION OF FACTORY OVERHEADS**

The first step in distribution of factory overhead costs is their collection and codification under proper headings. Similar overhead cost items should be grouped together. The grouping of overhead costs is done through a technique known as "codification". Codification is a method of identifying and describing various overhead expenses in numbers or letters or in a combination of both so that cost data can easily be collected. Codification of the entire items is done through a proper coding system. Following are briefly the objectives of codification:

1. To collect overhead items of similar nature.
2. To help in the allocation and apportionment of overhead costs to different departments or cost centres.
3. To make an analysis of overhead cost items for planning and control purposes.
4. To help in adopting a mechanised system of accounting.
5. To maintain a reasonable number of accounts which could be economical and useful.

### **Methods of Codification**

Generally, the codification follows Standing Order Number or Cost Accounting Number. Standing Order Number covers production overhead items and Cost Accounting Number includes administration, selling and distribution overhead items. However, both follow the same principle of accumulating overhead cost items. Some important methods of codification are the following:



**Serial Numbering System**

Under this method each item is allotted a fixed number in serial order, for example,

- 01 Factory supplies
- 02 Indirect labour
- 03 Insurance
- 04 Factory rent

**Number Blocks**

Under this method, a block number is assigned to cover items of expenditure, for example, 0–10 for maintenance expenses, 11–20 for supervision expenses, etc.

**Combination of Alphabets and Numbers**

Under this method a code is used which combines the number as well as the alphabets, for example,

- $M_1$  = Maintenance of plant
- $M_2$  = Maintenance of tools
- $M_3$  = Maintenance of factory building
- $M_4$  = Maintenance of office building

In the above example,  $M$  stands for maintenance and different numbers for different types of maintenance expenses.

**Numerical Codes**

Under this system, a code number usually consisting of nine digits is used. The first two digits signify whether the cost is fixed or variable, the next three indicate head of expense, the next two the analysis of expense for further subdivision, and the last two digits indicate the cost centre which incurs the expenditure, for example,.

10/121/05/08 Fixed/salary/officers/production.

**Mnemonic Method**

Under this method, the letters/alphabets are used to indicate an item such as D.P.T. for depreciation on plant and tools.

Among the above methods, the numerical code method is more suitable than the others for a large organisation. This method is easy to operate where a mechanical system of accounting is used. A large number of items could be covered under this method.

**Sources of Overhead Collection**

Different sources are available in an organisation to collect overhead expenses such as:

1. Store requisitions for items like indirect materials.
2. Financial accounts—A large number of items may be taken from the financial accounts of the business enterprise.
3. Wages book—Most indirect wages and labour-related costs.
4. Cash book—for indirect expenses.
5. Registers and reports—Plant and machinery register for depreciation; scrap, waste, spoilage can be discovered through investigation.

## ALLOCATION AND APPORTIONMENT OF FACTORY OVERHEADS

### Departmentalisation of Overhead

Departmentalisation of factory overhead means dividing the company into segments called departments or cost centres where expenses are incurred. In a manufacturing concern, there are mainly two types of cost centres—producing departments and service departments. A production department represents a subunit of the company where manufacturing activity takes place. Some typical examples of producing departments include assembly finishing, blending, painting and grinding departments. Service departments represent cost centres which provide support for the producing departments. Materials handling, personnel, plant maintenance, inspection, storage, purchasing, receiving, shipping, medical and other similar activities which are not directly involved in production are considered to be service activities.

### Benefits of Departmentalisation

Departmentalisation serves two purposes: (i) closer control of factory overhead costs, and (ii) more accurate costing of jobs and products. Closer control is possible because departmentalisation makes the incurrence of costs in a department or cost centre, the responsibility of someone who heads the department or the cost centre.

More accurate costing of jobs and products is possible, if products are passed through more than one department. A job or product going through a department is charged with factory overhead for work done on that product in that department. Therefore, jobs or products are charged with different amounts of factory overhead depending on the number of departments through which they pass. This process results in accurate and reliable cost figures for the products or job.

### Primary Distribution

Some factory overheads can be directly identified with a particular department or cost centre as having been incurred for that cost centre. Examples of such factory overheads are repairs and maintenance expenses incurred in specific departments, supervision, indirect labour, overtime, indirect materials and factory supplies, equipment depreciation.

Expenses such as power, light, rent, depreciation of factory building, expenses shared by all departments, cannot be charged directly to a department, be it producing or service. These expenses do not originate in any specific department. They are incurred for all and must, therefore, be apportioned or prorated to any or all departments using such items. Cost apportionment is the process of charging expenses in an equitable proportion to the various cost centres or departments. The Institute of Cost and Management Accountants (U.K.) defines cost apportionment, “as the allotment of proportions of items of cost to cost centres or cost units.” The apportionment should be done on some rational and equitable bases. In cost accounting this is known as primary distribution of factory overhead.

It would be difficult to give a comprehensive list of the bases of apportionment, but the following bases are in common use:

1. Floor area occupied—overheads such as lighting and heating, rent and rates, depreciation on building, building repairs, caretaking, watching and patrolling.
2. Capital values—Depreciation on plant and machinery, insurance on building, and plant and machinery, maintenance of plant and machinery.
3. Direct labour hours and/or machine hours—Insurance on jigs, tools and fixtures, power, works management remuneration, repairs and maintenance cost.

4. Number of workers employed—Canteen, accident insurance, medical, dental and first aid, pensions, personnel department expenses, profit sharing payments, recreation, supervision, time office, wages department.
5. Technical estimate—Fire prevention, oil and grease, steam, water without meter.

**Example 6.1**

The Moden Company has four departments. *A, B* and *C* are the production departments and *D* is a servicing department. The actual cost for a period are as follows:

		Rs. ('000)
<i>Indirect materials</i>		
Production department	<i>A</i>	950
	<i>B</i>	1,200
	<i>C</i>	200
Servicing department		1,500
<i>Indirect wages</i>		
Production department	<i>A</i>	900
	<i>B</i>	1,100
	<i>C</i>	300
Servicing department		1,000
Rent		2,000
Repair		1,200
Depreciation		900
Light		200
Supervision		3,000
Insurance		1,000
Employee's insurance (employer's liability)		300
Power		1,800

The following data are also available in respect of four departments:

	<i>Departments</i>			
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
Area (sq. ft)	150	110	90	50
No. of workers	24	16	12	8
Total wages ('000)	Rs. 8,000	Rs. 6,000	Rs. 4,000	Rs. 2,000
Value of plant ('000)	Rs. 24,000	Rs. 18,000	Rs. 12,000	Rs. 6,000
Value of stock ('000)	Rs. 15,000	Rs. 9,000	Rs. 6,000	—

Apportion the above costs to the various departments on the most equitable method.

**Solution:**

		<b>Departmental Distribution Summary</b>				<b>(Rs. '000)</b>	
<i>Items</i>	<i>Basis</i>	<i>Total</i>	<i>Production departments</i>		<i>Sevicing deptts.</i>		
			<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	
Indirect material	Allocation	3,850	950	1,200	200	1,500	
Indirect wages	Allocation	3,300	900	1,100	300	1,000	
Rent	Area	2,000	750	550	450	250	
Repairs	Plant value	1,200	480	360	240	120	

(Contd.)

(Contd.)

Items	Basis	Total	Production departments			Servicing depts.	
			A	B	C	D	
Depreciation	Plant value	900	360	270	180	90	
Light	Area	200	75	55	45	25	
Supervision	No of workers	3,000	1,200	800	600	400	
Insurance	Value of stock	1,000	500	300	200	—	
Employees Insurance	Wages	300	120	90	60	30	
Power	Plant value	1,800	720	540	360	180	
	Total	17,550	6,055	5,265	2,635	3,595	

Notes: (i) It has been assumed that insurance has been taken for stock.

(ii) Power expenses have been apportioned on the basis of value of plant because no other information has been given.

**Example 6.2**

Selfhelp Ltd. has gensets and produces its own power. Data for power costs are as follows:

Horse Power Hours	Production depts.		Service depts.	
	A	B	X	Y
Needed capacity production	10,000	20,000	12,000	8,000
Used during the month of May	8,000	13,000	7,000	6,000

During the month of May, costs for generating power amounted to Rs. 9,30,000; of this Rs. 2,50,000 was considered to be fixed cost. Service Deptt X renders service to A, B and Y in the ratio 13:6:1, while Y renders service to A and B in the ratio 3:1. Given that the direct labour hours in Depts A and B are 1,650 hours and 2,175 hours respectively, find the power cost per labour hour in each of these two Depts.

**Solution:****Selfhelp Ltd. Overheads Distribution Summary**

Particulars	Basis of charge	Total Rs.	Production depts		Service depts.	
			A	B	X	Y
(1)	(2)	(3)	Rs. (4)	Rs. (5)	Rs. (6)	Rs. (7)
Fixed Cost	H.P. Hours needed at capacity production (5:10:6:4)	2,50,000	50,000	1,00,000	60,000	40,000
Variable Cost	H.P. hours used (8:13:7:6)	6,80,000	1,60,000	2,60,000	1,40,000	1,20,000
Total overheads		9,30,000	2,10,000	3,60,000	2,00,000	1,60,000
Service Deptt.			1,30,000	60,000	-2,00,000	10,000
	X overheads apportioned to A, B and Y (13:6:1)					

(Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
Service Deptt.			1,55,000	15000		-1,70,000
Y overheads apportioned to A and B (31:3)						
Total overheads of production Deptts.		4,95,000		4,35,000	—	—
Labour hours worked		1,650		2,175		
Power cost per labour hour		300		200		

## APPORTIONMENT OF SERVICE DEPARTMENTS OVERHEADS TO PRODUCING DEPARTMENTS

### Secondary Distribution

The primary distribution of factory overhead apportions all overhead costs to the different departments or cost centres—production and service departments both. However, it is necessary that overhead costs of service departments (accumulated through direct allocation or primary distribution) should be further assigned to producing departments. This is due to the reason that service departments do not themselves manufacture anything and it is the production departments or cost centres which are involved in manufacturing activities. The reassignment or reapportionment of service departments overhead to producing departments or centres is termed as secondary distribution.

Secondary distribution is useful in the following manner:

1. It helps in determining the cost of products or jobs sold and value of inventory.
2. It helps in determining the effect of various managerial decisions and actions on the total cost of the business firm. For example, decisions as to add or to drop a product line require information about its cost effect, which can be estimated after secondary distribution has been made.
3. It helps subsequently in determining the price of the product or job. In case of contracts based on cost in place of market price, secondary distribution helps in fixing a selling price which is advantageous to the parties concerned.
4. It promotes motivation among employees of the producing departments to take up service department activities.

### Bases for Secondary Distribution

It is difficult to suggest a sample list of service departments and equitable bases of distribution of overhead costs. The general basis for apportioning service departments' overheads to producing departments are the following:

1. *Services rendered (benefits obtained)*—This is perhaps the most popular method of apportioning service department costs. The services rendered to different departments, that is, benefits obtained by them can be a suitable basis. If a producing department has received large benefits, it must be charged for a share of overhead costs incurred to provide that quantity of benefits. This method is simple and economical.
2. *Ability to pay*—This method suggests that a large share of servicing departments overhead costs should be assigned to those producing departments whose product contributes the most to the income of a business enterprise. However, it is difficult to measure the “ability to pay” of different departments and this method is also not based on equity.

3. *Survey or analysis*—This method is applied where a suitable base is difficult to find or it would be too costly to select a method which is considered suitable. For example, the postage cost could be apportioned on a survey of postage used during a year.
4. *Efficiency or incentives*—This method uses standards and budgets and apportions the overhead costs on the basis of a present budget or standard. Sometimes, this method is used along with the bases of services rendered or ability to pay method.

In selecting a suitable base for apportioning service department overheads, considerations should be given to practicability, simplicity, economy, theoretical soundness and assistance in accurate costing and cost control.

The following list gives a few service departments and bases commonly used to apportion the respective overhead costs:

<i>Service Department</i>	<i>Apportionment Base</i>
Personnel	Number of employees, labour hours, labour cost.
Purchasing	Number of orders, cost of materials.
Receiving	Cost of materials, number of units, number of orders.
Stores	Cost of materials, number of requisitions filled, number of units handled.
Factory Office	Number of employees, labour hours, labour cost.
Machine Maintenance and Repair	Machine hours, labour hours, labour cost, services rendered.
Engineering	Machine hours, labour hours, service rendered.
Payroll or Time-keeping Department	Total labour or machine hours or number of employees in each department.
Welfare, Canteen, Recreation, Medical	Number of employees in each department.
Building Service Department	Relative area of each department.
Internal Transport Service	Weight, value, graded products, weight and distance.

### Inter-departmental Services

While apportioning service departments overheads, one may notice two situations: (i) The entire amount of a servicing department is to be distributed to only the producing departments. This does not involve any practical difficulty and provides the simplest and quickest method for apportioning costs of the servicing department. (ii) Services provided by some servicing departments are used partly by other servicing departments. That is, many service departments serve each other. For example, the payroll department in a firm prepares payroll for the entire organisation, but it depends on the building maintenance department for repair and maintenance services. Similarly, the building maintenance department provides services for all departments using the building, but it gets service from departments like stores, factory office, and personnel. This second situation is known as inter-departmental services.

### Methods

There are mainly two methods of dealing with inter-departmental service:

- A. *Continuous apportionment* In this method, the process of apportioning service departments overhead is continued until the figures become immaterial or totally exhausted. The following steps are involved in this method:
  - (a) Use the given percentages to apportion the original total of the first service department. This closes the account of the first service department and transfers prorated amounts to other departments.

- (b) Use the given percentages of second service department whose total is made up of original amount plus prorated amount of service department first. This closes the account of second service department and assigns prorated amounts to the other departments including service department first also.
- (c) Follow the same procedure to all other service departments.
- (d) Repeat a second cycle of apportionment starting with the service department first, whose total consists, at present, only of amounts prorated from other service departments. In this way, the service department totals become less and less with each cycle of apportionment because each time a substantial amount is apportioned to the producing departments.
- (e) Stop the above cycle at any point where it is found that the remaining figure (to be apportioned) are too small to be of any consequence or when the figures are totally exhausted.

**Example 6.3**

The overhead of a manufacturing company has been analysed to the point of primary distribution as given below.

		Rs.
Production departments:	Machine	10,00,000
	Assembly	4,00,000
Service departments:	Canteen	2,00,000
	Powerhouse	3,00,000

The canteen is to be apportioned on the basis of employees:

	Employees	%
Machine	240	60
Assembly	140	35
Powerhouse	20	5
	400	100

The powerhouse is to be apportioned on the basis of electricity used:

	Thousand kilowatts	%
Machine	270	75
Assembly	36	10
Canteen	54	15
	360	100

**Solution:**

The apportionment would be done in the following manner:

	<i>Machine</i>	<i>Assembly</i>	<i>Canteen</i>	<i>Powerhouse</i>
Primary apportionment	10,00,000	4,00,000	2,00,000	3,00,000
Apportion: Canteen	1,20,000	70,000	- 2,00,000	10,000
Powerhouse	2,32,500	31,000	46,500	- 3,10,000
Canteen	27,900	16,300	- 46,500	2,300
Powerhouse	1,800	200	300	- 2,300
Canteen	200	100	- 300	
Total Service Deptts.	3,82,400	1,17,600		
Total Production Overhead	13,82,400	5,17,600		

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3. *Survey or analysis*—This method is too costly to

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*B. Algebraic method or simultaneous equation* This method helps in finding out the amount of overhead of each servicing department by solving simultaneous equations. The total expenses of service departments can be directly transferred to production departments.

**Example 6.4**

A company has three production departments, *A*, *B* and *C* and two service departments, *P* and *Q*. The following figures are available as per departmental distribution summary:

		Rs.
Production departments	<i>A</i>	3,150
	<i>B</i>	3,700
	<i>C</i>	1,400
Service departments	<i>P</i>	2,250
	<i>Q</i>	1,000

The expenses of the service departments are to be apportioned on a percentage basis as follows:

		<i>A</i>	<i>B</i>	<i>C</i>	<i>P</i>	<i>Q</i>
Service deptt. <i>P</i>		40%	30%	20%	—	10%
Service deptt. <i>Q</i>		30%	30%	20%	20%	—

**Solution:**

Let  $X$  = total overhead of deptt. *P*  
 $Y$  = total overhead of deptt. *Q*

Therefore 
$$X = 2,250 + \frac{20}{100} Y \tag{1}$$

$$Y = 1,000 + \frac{10}{100} X \tag{2}$$

$$10X = 22,500 + 2Y \tag{3}$$

$$10Y = 10,000 + 1X \tag{4}$$

Multiplying Eq. (3) by 5

$$50X - 10Y = 1,12,500 \tag{5}$$

$$-X + 10Y = 10,000 \tag{6}$$

Adding 
$$49X = 1,22,500$$

$$X = 2,500$$

and 
$$Y = 1,250$$

**Secondary Distribution Summary**

	<i>Total</i>	<i>Production Department</i>			<i>Servicing Deptt.</i>	
	Rs.	<i>A</i> Rs.	<i>B</i> Rs.	<i>C</i> Rs.	<i>P</i> Rs.	<i>Q</i> Rs.
As per summary	11,500	3,150	3,700	1,400	2,250	1,000
Service deptt. <i>P</i>		1,000	750	500	-2,250	250
	11,500	4,150	4,450	1,900		-1,250
Service deptt. <i>Q</i>		375	375	250	250	-1,250
	11,500	4,525	4,825	2,150	—	—