ILLUSTRATIONS

1. Segregation of Semi-Variable Expenses

Illustration 1: Analysis of Semi-Variable Costs **M 85**

The following are the Maintenance Costs incurred in a Machine Shop for six months with corresponding machine hours. Analyse the Semi-Variable Maintenance Costs into Fixed & Variable elements by High and Low Points Method.

Month	Jan	Feb	Mar	Apr	May	June	Total
Maintenance Costs Rs.000s	30	32	27	34	28	29	180
Machine Hours	2,000	2,200	1,700	2,400	1,800	1,900	12,000

Solution: **Note:** High Point (maximum) is in **April** month and Low Point (minimum) is in **March** month.

1. **Variable Cost per hour** (using High and Low Points Method) $= \frac{\text{Difference in Costs}}{\text{Difference in Hours}} = \frac{\text{Rs.34,000} - \text{Rs.27,000}}{(2{,}400 - 1{,}700)\text{ hours}} = \text{Rs.10 per machine hour.}$

2. **Fixed Cost** = Total Costs **less** Variable Costs (estimated using January month data)
   = Rs.30,000 – (2,000 hours × Rs.10) **= Rs.10,000** **[Note:** Any other month can also be taken here.]

3. Analysis of Costs into Fixed and Variable Portions:

Month	Jan	Feb	Mar	Apr	May	Jun
(a) Machine Hours	2,000	2,200	1,700	2,400	1,800	1,900
(b) Total Maintenance Costs (given)	Rs.30,000	Rs.32,000	Rs.27,000	Rs.34,000	Rs.28,000	Rs.29,000
(c) Fixed Costs (**WN 2**)	Rs.10,000	Rs.10,000	Rs.10,000	Rs.10,000	Rs.10,000	Rs.10,000
(d) Variable Costs (b – c)	Rs.20,000	Rs.22,000	Rs.17,000	Rs.24,000	Rs.18,000	Rs.19,000

Illustration 2: Analysis of Semi-Variable Costs **N 09**

From the following information, calculate the amount of Variable OH per unit & amount of Total Fixed OH for the whole year.

Particulars	1st Apr to 30th Jun	1st Jul to 31st Mar
Output (units)	10,000	35,000
Total Overheads (Rs.)	40,000	1,35,000

Solution:

1. Variable OH per unit= Change in OH ÷ Change in Output Qtty=(1,35,000 – 40,000) ÷ (35,000 – 10,000)	**Rs.3.80 pu**
2. Total Fixed OH (for I Half Year) = Total OH – Variable OH = Rs.40,000 – (10,000 units × Rs.3.80 pu)	Rs.2,000
3. Hence, Total Fixed OH for the whole year = Rs.2,000 × 2	**Rs.4,000**

2. Capacity Concepts

Illustration 2: Capacity Concepts **N 08**

A Machinery was purchased from a Manufacturer who claimed that his Machine could produce 36.5 tonnes in a year consisting of 365 days. Holidays, breakdown, etc. were normally allowed in the factory for 65 days. Sales were expected to be 25 tonnes during the year and the plant actually produced 25.2 tonnes during the year. You are required to state – (a) Rated Capacity, (b) Practical Capacity, (c) Normal Capacity, and (d) Actual Capacity.

Solution:

1. Rated Capacity = Maximum Capacity = 36.5 tonnes. 2. Practical Capacity (for 365 – 65 = 300 days) = $36.5 \times \frac{300}{365}$ = 30.0 tonnes.	3. Normal Capacity = Expected Production = 25.0 tonnes. 4. Actual Capacity = Actual Production = 25.2 tonnes.

Illustration 3: Capacity Concepts

Ram Ltd manufactures a product at the rate of 10 pieces per hour. The Company has been producing and selling 3,30,000 units annually during the previous 6 years. However, during this year the Company was able to produce 3,16,000 units only. The Company's Overheads for this year amounted to Rs.6,75,000.

The Company has 15 machines (of the same type) and works on single shift only, i.e. 8 hours per day. During a year, statutory and festival–related holidays are expected to be 65 days. The quarterly preventive maintenance and repairs work can be taken at 250 hours. Calculate –

1. **Maximum Capacity, Practical Capacity, Normal Capacity, Actual Capacity and Idle Capacity in terms of hours and units,**
2. **Hourly Rate of Recovery of Overhead for Maximum, Practical, Normal and Actual Capacities.**
3. **Cost of Idle Capacity.**

Solution:

Capacity	Computation	M/c Hrs	Units	OH Rate ph
1. Maximum Capacity	365 days × 8 hours × 15 machines	43,800	43,800×10= 4,38,000	Rs.15.41
2. Practical Capacity	= Max. Capacity **less** Unavoidable Idle Time = 43,800 – [(65 × 8 × 15) + (250 × 4 qtrs)]	35,000	35,000×10= 3,50,000	Rs.19.29
3. Normal Capacity	Based on Sales Expectancy = 3,30,000 / 10.units.p.h.	33,000	Given = 3,30,000	Rs.20.45
4. Actual Capacity	Based on Actual Production = 3,16,000 / 10.units.p.h.	31,600	Given = 3,16,000	Rs.21.36
5. Idle Capacity	= Normal Capacity **less** Actual Capacity = 2,000 – 1,825	1,400	1,400×10= 14,000	NA

Note: Rate per hour is determined by dividing Rs.6,75,000 by the Machine Hours denoted in Column 3.
Rate based on Normal Capacity is generally used for Overhead Absorption.
Cost of Idle Capacity = 1,400 hours × Rs.20.45 ph (OH Rate based on Normal Capacity) = **Rs.28,630.**

3. Re-apportionment of Service Dept Exps under 3 Methods

Illustration 4: Apportionment and Direct Re–distribution **M 07**

A Company has three Production Departments (M1, M2 and A1) and three Service Departments, one of which Engineering Service Department, servicing the M1 and M2 only. The relevant information is as follows:

	Product X	Product Y
M1	10 Machine hours	6 Machine hours
M2	4 Machine hours	14 Machine hours
A1	14 Direct Labour hours	18 Direct Labour hours

The annual Budgeted Overhead Costs for the year are –

Particulars	M1	M2	A1	Stores	Engineering Services	General Services
Indirect Wages	Rs.46,520	Rs.41,340	Rs.16,220	Rs. 8,200	Rs. 5,340	Rs. 7,520
Consumable Supplies	Rs.12,600	Rs.18,200	Rs. 4,200	Rs. 2,800	Rs. 4,200	Rs. 3,200

The annual Budgeted Overhead Costs for the year are – (continued)

Depreciation on Machinery		Rs.39,600	Power		Rs. 6,480
Insurance of Machinery		Rs. 7,200	Light		Rs. 5,400
Insurance of Building	(See Note 1)	Rs. 3,240	Rent	(See Note 2)	Rs.12,675

Notes:

1. **Total Building Insurance Cost for M1 is one third of annual premium.**
2. **The General Service Department Is located in a building owned by the Company. It is valued at Rs.6,000 and is charged into cost at Notional Value of 8% per annum. This cost is additional to the rent shown above.**
3. **The value of issues of materials to the Production Departments are in the same proportion as shown above for the Consumable Supplies.**

The following data are also available:

Department	Book Value of Machinery (Rs.)	Area (Sq.ft.)	Effective H.P Hours%	Production Direct Labour hours	Capacity Machine hours
M1	1,20,000	5,000	50	2,00,000	40,000
M2	90,000	6,000	35	1,50,000	50,000
A1	30,000	8,000	05	3,00,000	
Stores	12,000	2,000	–		
Engineering Services	36,000	2,500	10		
General Services	12,000	1,500	–		

Required:

1. **Prepare a Overhead Analysis Sheet, showing the bases of apportionment of overhead to Departments.**
2. **Allocate Service Department Overheads to Production Departments ignoring the apportionment of Service Department Costs among Service Departments.**
3. **Calculate suitable Overhead Absorption Rate for the Production Departments.**
4. **Calculate the Overheads to be absorbed by two products, X and Y.**

Solution:

1. **Insurance on Building** = 1/3rd of Rs.3,240 = Rs.1,080 is charged to M1. Balance 2/3rd, i.e. Rs.2,160 is apportioned to the other Departments, in the ratio of Floor Area, as under –

Department	M2	A1	Stores	Engg.	General	Total
Area in sq ft	6,000	8,000	2,000	2,500	1,500	20,000
Insurance apportioned	Rs.648	Rs.864	Rs.216	Rs.270	Rs.162	Rs.2,160

2. **Rent** of Rs.12,675 is charged to all Departments (except General Services Department) as under –

Department	M1	M2	A1	Stores	Engg.	Total
Area in sq ft	5,000	6,000	8,000	2,000	2,500	23,500
Rent apportioned	Rs.2,697	Rs.3,236	Rs.4,315	Rs.1,079	Rs.1,348	Rs.12,675

Rent of General Services Department (Direct Charge) = 8% of Rs.6,000 = **Rs.480.**

3. Statement of Overheads

Particulars	Basis	M1	M2	A1	Stores	Engg.	General	Total
Depreciation on M/c	Book Value of M/c (120:90:30:12:36:12)	15,840	11,880	3,960	1,584	4,752	1,584	39,600
Insurance of M/c	Book Value of M/c (120:90:30:12:36:12)	2,880	2,160	720	288	864	288	7,200
Insurance of Building	**See WN 1 above**	1,080	648	864	216	270	162	3,240
Power	Effective HP Hours % (50:35:05:Nil:10:Nil)	3,240	2,268	324	Nil	648	Nil	6,480
Light	Area in Sq.Feet (50:60:80:20:25:15)	1,080	1,296	1,728	432	540	324	5,400
Rent	**See WN 2 above**	2,697	3,236	4,315	1,079	1,348	480	13,155
Indirect Wages	Given (Direct Allocation)	46,520	41,340	16,220	8,200	5,340	7,520	1,25,140
Consumable Supplies	Given (Direct Allocation)	12,600	18,200	4,200	2,800	4,200	3,200	45,200
Total OH before re–apportionment		**85,937**	**81,028**	**32,331**	**14,599**	**17,962**	**13,558**	**2,45,415**
Re–apportionment of Serv. Dept. Exps								
Stores (in Consumables) (126:182:42)		5,256	7,591	1,752	(14,599)	Nil	Nil	**Nil**
Engg Serv.(on m/c hrs) (M1, M2 only)		7,983	9,979	Nil	Nil	(17,962)	Nil	**Nil**
Gen. Services (on DLH) (20:15:30)		4,172	3,129	6,257	Nil	Nil	(13,558)	**Nil**
Total OH of Production Departments		**1,03,348**	**1,01,727**	**40,340**	**Nil**	**Nil**	**Nil**	**2,45,415**
Recovery Base (i.e. Cost Driver)		m/c hours	m/c hours	DLH				
Quantity of Recovery Base		40,000 m/c hours	50,000 m/c hours	3,00,000 DLH				
OH Recovery Rate (Rs.)		2.58 per m/c hr	2.03 per m/c hr	0.13 per DLH				

4. Computation of OH Cost of the Products

Department	Product X	Product Y
M1	10 Machine hours × Rs.2.58 = Rs.25.80	6 Machine hours × Rs.2.58 = Rs.15.48
M2	4 Machine hours × Rs.2.03 = Rs. 8.12	14 Machine hours × Rs.2.03 = Rs.28.42
A1	14 Direct Labour hours × Rs.0.13= Rs. 1.82	18 Direct Labour hours × Rs.0.13 = Rs. 2.34
Total OH	**Rs.35.74**	**Rs.46.24**

Illustration 5: Re-apportionment – Direct Method and Step Ladder Method **M 05**

An Engine manufacturing Company has two Production Departments – (i) Snow Mobile Engine, and (ii) Boat Engine, and two Service Departments – (i) Maintenance, and (ii) Factory Office. Budgeted Cost and relevant cost drivers are –

Department	Snow Mobile Engine	Boat Engine	Factory Office	Maintenance
Costs in Rs.	Rs.6,00,000	Rs.17,00,000	Rs.3,00,000	Rs.2,40,000

Cost Drivers are as under –

Department	Factory Office Department	Maintenance Department
Cost Driver	Number of Employees	Number of Work Orders
Snow Mobile Engine Department	1,080 Employees	570 Orders
Boat Engine Department	270 Employees	190 Orders
Factory Office Department	—	40 Orders
Maintenance Department	150 Employees	—
Total	1,500 Employees	800 Orders

1. Compute the Cost Driver Allocation percentage and then use these percentages to allocate the Service Department Costs by using Direct Method.
2. Compute the Cost Driver Allocation percentage and then use these percentages to allocate the Service Department Costs by using Non-Reciprocal Method / Step Method.

Solution: **1. Apportionment of Service Department OH using Direct Method**

Department		Snow Mobile Engine	Boat Engine	Total
	Overhead Cost as given	6,00,000	17,00,000	23,00,000
Add:	Factory Office Costs apportioned to Prodn Departments in ratio of no. of employees (1,080 : 270) i.e. **(80%, 20%)**	2,40,000	60,000	3,00,000
Add:	Maint. Dept. Costs apportioned to Prodn Departments in ratio of no.of work orders (570:190) i.e. **(75%, 25%)**	1,80,000	60,000	2,40,000
Total OH		**10,20,000**	**18,20,000**	**28,40,000**

2. Apportionment of Service Department OH using Step Method (taking Factory Office first)

Department	Factory Office	Maint-enance	Snow Mobile	Boat Engine	Total
Overhead Cost as given	3,00,000	2,40,000	6,00,000	17,00,000	28,40,000
Factory Office Costs apportioned based on no. of employees (150:1080 : 270) i.e. **(10%,72%,18%)**	(3,00,000)	30,000	2,16,000	54,000	—
Maintenance Dept. Costs apportioned based on no. of work orders (570 : 190) i.e. **(75%, 25%)**	—	(2,70,000)	2,02,500	67,500	—
Total OH	**Nil**	**Nil**	**10,18,500**	**18,21,500**	**28,40,000**

Illustration 6: Re-apportionment – Direct Method and Step Ladder Method **N 06**

RST Ltd has two production departments: Machining and Finishing. There are three service departments: Human resource (HR), Maintenance and Design. The budgeted costs in these service departments are as follows –

Particulars	HR (in Rs.)	Maintenance (in Rs.)	Design (in Rs.)
Variable	1,00,000	1,60,000	1,00,000
Fixed	4,00,000	3,00,000	6,00,000
Total	5,00,000	4,60,000	7,00,000

The usage of these departments output during the year just completed is as follows –

Provision of Service Output (in hours of service)	Providers of Service		
Users of Service	HR	Maintenance	Design
HR	–	–	–
Maintenance	500	–	–
Design	500	500	–
Machining	4,000	3,500	4,500
Finishing	5,000	4,000	1,500
Total	10,000	8,000	6,000

Required –

1. **Use the Direct Method to re–apportion RST Ltd's Service Department Costs to its Production Departments.**
2. **Determine the proper sequence to use in re–apportioning the Firm's Service Department Costs by Step–down Method.**
3. **Use the Step–Down Method to re–apportion the Firm's Service Department Costs to Production Departments.**

Solution: **1. Apportionment of OH under Direct Method**

Particulars	Basis	Machining	Finishing	Total
HR Costs	4,000 : 5,000	2,22,222	2,77,778	5,00,000
Maintenance Costs	3,500 : 4,000	2,14,667	2,45,333	4,60,000
Design Costs	4,500 : 1,500	5,25,000	1,75,000	7,00,000
Total OH		**9,61,889**	**6,98,111**	**16,60,000**

2. Order of apportionment under Step Method: (1) HR, (2) Maintenance, (3) Design. (in order of hours of service)

3. Apportionment of OH under Step Method

Particulars and Basis	HR	Maintenance	Design	Machining	Finishing
OH as given	5,00,000	4,60,000	7,00,000	–	–
Apportionment of Service Costs					
HR (500 : 500 : 4,000 : 5,000)	(5,00,000)	25,000	25,000	2,00,000	2,50,000
Maintenance (500 : 3,500 : 4,000)	–	(4,85,000)	30,313	2,12,187	2,42,500
Design (4,500 : 1,500)	–	–	(7,55,313)	5,66,485	1,88,828
Total OH	**–**	**–**	**–**	**9,78,672**	**6,81,328**

Illustration 7: Re–apportionment – Repeated Redistribution Method

Gold Coast Ltd gives you the following information to compute the production hour rate of recovery of Overheads in three Production Departments A, B and C.

	Production Departments			Service Departments		
Particulars	**A**	**B**	**C**	**P**	**Q**	**Total**
Rent	**2,400**	**4,800**	**2,000**	**2,000**	**800**	**12,000**
Electricity	**800**	**2,000**	**500**	**400**	**300**	**4,000**
Indirect Labour	**1,200**	**2,000**	**1,000**	**800**	**1,000**	**6,000**
Machinery Depreciation	**2,500**	**1,600**	**200**	**500**	**200**	**5,000**
Sundries	**910**	**2,143**	**847**	**300**	**300**	**4,500**
Total OH	**7,810**	**12,543**	**4,547**	**4,000**	**2,600**	**31,500**
Working Time (Hours)	**1,000**	**2,500**	**1,400**			

Expenses of Service Departments P and Q are to be apportioned as under –

Particulars	A	B	C	P	Q
P	30	40	20	–	10
Q	10	20	50	20	–

Compute the OH recovery rates of the three departments. (Use Repeated Redistribution Method).

Solution: Note: Under Repeated Re–Distribution Method, Service Department Costs are continuously re–apportioned to the other Departments in the given ratio, till the balance OH in each Service Dept. becomes NIL or a very negligible amount.

Statement of OH (using Repeated Re–distribution Method)

Particulars		A	B	C	P	Q	Total
Overhead as above		7,810	12,543	4,547	4,000	2,600	31,500
Re–apportionment:	P's OH	1,200	1,600	800	(4,000)	400	Nil
	Q's OH	300	600	1,500	600	(3,000)	Nil
	P's OH (balance)	180	240	120	(600)	60	Nil
	Q's OH (balance)	6	12	30	12	(60)	Nil
	P's OH (balance)	4	5	3	(12)	Nil	Nil
Total OH		**9,500**	**15,000**	**7,000**	**Nil**	**Nil**	**31,500**
Working Hours		1,000	2,500	1,400			
Overhead Rate per hour		**9.50**	**6.00**	**5.00**			

DM, DL of Production department not to be used in OH Calculation.

Illustration 8: Re-apportionment – Simultaneous Equations Method

PHC Ltd is a manufacturing Company having three Production Departments, 'A', 'B' and 'C' and two Service Departments 'X' and 'Y'. The following is the budget for December –

Particulars	A	B	C	X	Y
Direct Material Rs.	1,000	2,000	4,000	2,000	1,000
Direct Wages Rs.	5,000	2,000	8,000	1,000	2,000
Area in Square feet	500	250	500	250	500
Cost of Assets Rs. Lakhs	20.00	40.00	20.00	10.00	10.00
HP of Machines	50	40	20	15	25
Machine Hours	1,000	2,000	4,000	1,000	1,000

Overheads to be apportioned among the various departments are –

Factory Rent – Rs.40,000, Power – Rs.25,000, Depreciation – Rs.10,000, – Sundries Rs.90,000

Technical assessment for the apportionment of expense of Service Departments is as under –

Department	A	B	C	X	Y
X	45%	15%	30%	–	10%
Y	60%	35%	–	5%	–

1. **Prepare a statement showing distribution of overheads to various departments.**
2. **Prepare a statement showing re-distribution of Service Departments' Expenses to Production Departments.**
3. **Compute the Machine Hour Rates of the Production Departments 'A','B' and 'C'.**

Solution:

Special Points:

- **Deemed OH:** Direct Materials and Direct Wages of Service Departments X and Y, are in effect, Indirect Costs. This is because there is **no output** in a Service Department and hence, no direct costs in a Service Department. Hence, these costs are **Deemed Overheads**, and are **added** to the Overheads of the respective Service Departments.
- **Power Cost Apportionment:** Power Cost may be apportioned in the ratio of HP rating only, if Working Hours or Labour Hours are given in the question. But if **Machine Hours** are given, it is better to apportion the Power Cost in the combined ratio of HP rating × Machine Hours, derived as under.

HP × Machine Hours	50,000	80,000	80,000	15,000	25,000

1. Statement of OH

Particulars and Basis	A	B	C	X	Y	Total
Factory Rent (on Area) (50 : 25 : 50 : 25 : 50)	10,000	5,000	10,000	5,000	10,000	40,000
Power (on HP × M/c hours) (50 : 80: 80: 15 : 25)	5,000	8,000	8,000	1,500	2,500	25,000
Depreciation (on M/c Value) (20 : 40 : 20 : 10: 10)	2,000	4,000	2,000	1,000	1,000	10,000
Sundries (on Direct Wages) (5 : 2 : 8 : 1 : 2)	25,000	10,000	40,000	5,000	10,000	90,000
Direct Materials of Service Departments (Actuals)	–	–	–	2,000	1,000	3,000
Direct Wages of Service Departments (Actuals)	–	–	–	1,000	2,000	3,000
Total OH before re-apportionment	**42,000**	**27,000**	**60,000**	**15,500**	**26,500**	**1,71,000**
Re-apportionment of Serv.Dept. Exps (**WN 2 below**)						
X	7,609	2,537	5,073	(16,910)	1,691	Nil
Y	16,915	9,866	Nil	1,410	(28,191)	Nil
Total OH (after re-apportionment)	**66,524**	**39,403**	**65,073**	**–**	**–**	**1,71,000**
Machine Hours	1,000	2,000	4,000			
OH Rate (in Rs. per Machine Hour)	**66.52**	**19.70**	**16.27**			

Note: Initially, the above statement is prepared upto Total OH (before re-apportionment) stage. Thereafter, Simultaneous Equations are formulated and solved as indicated in **WN 2** below. Thereafter, the above OH Statement is continued from re-apportionment onwards.

2. Simultaneous Equations are framed and solved as under –

$X = 15,500 + 5\%Y.$ So, $X = 15,500 + \frac{1}{20} Y$ ..... **Equation 1**

$Y = 26,500 + 10\% X.$ So, $Y = 26,500 + \frac{1}{10} X$ ..... **Equation 2**

Substituting the value of X in Equation 2, we have,

$$Y = 26,500 + \frac{1}{10}(15,500 + \frac{1}{20}Y).$$

$$Y = 26,500 + 1,550 + \frac{1}{200}Y$$

$$Y - \frac{1}{200}Y = 28,050, \quad \text{i.e. } \frac{199}{200}Y = 28,050. \quad \text{So, } Y = 28,050 \times \frac{200}{199} = \mathbf{28,191}$$

Substituting the value of Y in Equation 1, we have $X = 15,500 + (\frac{1}{20} \times 28,191) = \mathbf{16,910}$

Note:
The values of X and Y obtained after solving the above Simultaneous Equations should be **higher** than the OH Costs of these Service Departments obtained earlier. These bigger values are then used for OH re–apportionment.

Illustration 9: Re–apportionment – Simultaneous Equations Method **RTP**

ABC Ltd. budgets the following amounts for its two service departments (Legal and Personnel) in supporting each other and the two production divisions the Micro Computer Division (MCD) and the Peripheral Equipment Division (PED). Budgeted Capacity is as under –

To be supplied by	MCD	PED	Legal	Personnel	Total
Legal (hours)	3,000	1,500	–	500	5,000
Legal (%)	60%	30%	–	10%	100%
Personnel (hours)	45,000	50,000	5,000	–	1,00,000
Personnel (%)	45%	50%	5%	–	100%

Details on actual usage are as follows:

To be supplied by	MCD	PED	Legal	Personnel	Total
Legal (hours)	800	2,400	–	800	4,000
Legal (%)	20%	60%	–	20%	100%
Personnel (hours)	53,200	22,800	4,000	–	80,000
Personnel (%)	66.5%	28.5%	5%	–	100%

The actual expenses were: Legal Department: Fixed Rs.7,20,000 and Variable Rs.4,00,000
Personnel Department: Fixed Rs.9,50,000 and Variable Rs.12,00,000

Fixed Expenses are allocated on the basis of budgeted capacity. Variable expenses are allocated on the basis of actual usage. You are required to prepare a statement showing apportionment of expenses of Service Departments (Legal and Personnel) to Production Divisions MCD and PED, by using Simultaneous Equations Method.

Solution: **1. Summary of Overheads:** The Expenses to be apportioned are as under –

- Legal Department: Fixed Rs.7,20,000 and Variable Rs.4,00,000 — Rs. 11,20,000
- Personnel Department: Fixed Rs.9,50,000 and Variable Rs.12,00,000 — Rs. 21,50,000
- Hence Grand Total of Expenses to be apportioned = **Rs.32,70,000**

2. Apportionment of Fixed Expenses

Let Fixed Expenses of Legal and Personnel Departments be Rs.A and Rs.B respectively. Hence, the simultaneous equations for Fixed Expenses are framed as under –

$$A = 7,20,000 + 5\%\ B. \quad \text{So, } A = 7,20,000 + \frac{1}{20}B \ldots\ldots \textbf{Equation 1}$$

$$B = 9,50,000 + 10\%\ A. \quad \text{So, } B = 9,50,000 + \frac{1}{10}A \ldots\ldots \textbf{Equation 2}$$

Substituting the value of A in Equation 2, we have,

$$B = 9,50,000 + \frac{1}{10}(7,20,000 + \frac{1}{20}B). \quad \text{On simplification, } B = 9,50,000 + 72,000 + \frac{1}{200}B$$

$$B - \frac{1}{200}B = 10,22,000. \quad \text{So, } \frac{199}{200}B = 10,22,000. \quad \text{Hence, } B = 10,22,000 \times \frac{200}{199} = \mathbf{10,27,136.}$$

Substituting the value of B in Equation 1, $A = 7,20,000 + (\frac{1}{20} \times 10,27,136) = \mathbf{7,71,357.}$

3. Apportionment of Variable Expenses

Let Variable Expenses of Legal and Personnel Departments be Rs.X & Rs.Y respectively. Hence, the simultaneous equations for Variable Expenses are as under –

$X = 4,00,000 + 5\%Y.$ So, $X = 4,00,000 + \frac{1}{20}Y$..... **Equation 1**

$Y = 12,00,000 + 20\%\ X.$ So, $Y = 12,00,000 + \frac{1}{5}X$..... **Equation 2**

Substituting the value of X in Equation 2, we have,

$Y = 12,00,000 + \frac{1}{5}(4,00,000 + \frac{1}{20}Y)$. On simplification, $Y = 12,00,000 + 80,000 + \frac{1}{100}Y$

$Y - \frac{1}{100}Y = 12,80,000$ So, $\frac{99}{100}Y = 12,80,000$ Hence, $Y = 12,80,000 \times \frac{100}{99}$ = **12,92,929.**

Substituting the value of Y in Equation 1, $X = 4,00,000 + (\frac{1}{20} \times 12,92,929)$ = **4,64,646.**

4. Secondary Distribution Summary

Particulars	MCD	PED	Legal	Personnel	Total
Overhead as apportioned and given	–	–	11,20,000	21,50,000	32,70,000
Re–apportionment:					
Legal: Fixed Expenses (60%, 30%, 10%)	4,62,814	2,31,407	(7,71,357)	77,136	–
Legal: Variable Expenses (20%, 60%, 20%)	92,929	2,78,788	(4,64,646)	92,929	–
Personnel: Fixed Expenses (45%, 50%, 5%)	4,62,211	5,13,568	51,357	(10,27,136)	–
Personnel: Variable Exps (66.5%, 28.5%, 5%)	8,59,798	3,68,485	64,646	(12,92,929)	–
Total OH	**18,77,752**	**13,92,248**	**Nil**	**Nil**	**32,70,000**

Note: Fixed Expenses are apportioned based on Budgeted Capacity Ratio, and Variable Expenses are apportioned based on Actual Usage Ratio.

Illustration 10: Re–apportionment – Simultaneous Equations Method **N 07**

ABC Ltd. has three Production Departments P_1, P_2 and P_3 and two Service Departments S_1 and S_2. The following data are extracted from the records of the Company for the month of October:

Particulars	Rs.	Particulars	Rs.
Rent and Rates	62,500	Power	25,000
General Lighting	7,500	Depreciation on Machinery	50,000
Indirect Wages	18,750	Insurance of Machinery	20,000

Other Information:

Particulars	P_1	P_2	P_3	S_1	S_2
Direct Wages (Rs.)	37,500	25,000	37,500	18,750	6,250
Horse Power of Machines used	60	30	50	10	–
Cost of Machinery (Rs.)	3,00,000	4,00,000	5,00,000	25,000	25,000
Floor Space (Sq. ft)	2,000	2,500	3,000	2,000	500
Number of Light Points	10	15	20	10	5
Production Hours worked	6,225	4,050	4,100	–	–

Expenses of the Service Departments S_1 and S_2 are re–apportioned as below:

	P_1	P_2	P_3	S_1	S_2
S_1	20%	30%	40%	–	10%
S_2	40%	20%	30%	10%	–

Required:

1. **Compute Overhead Absorption Rate per production hour of each Production Department.**
2. **Determine the Total Cost of Product X which is processed for manufacture in Department P_1, P_2 and P_3 for 5 hours, 3 hours and 4 hours respectively, given that its Direct Material Cost is Rs.625 and Direct Labour Cost is Rs.375.**

Solution: **1. Statement of OH**

Particulars and Basis	P_1	P_2	P_3	S_1	S_2	Total
Rent and Rates (on Floor Space) (20 : 25 : 30 : 20 : 5)	12,500	15,625	18,750	12,500	3,125	62,500
General Lighting (on Light Points) (10 : 15 : 20 : 10 : 5)	1,250	1,875	2,500	1,250	625	7,500
Indir. Wages (on Dir.Wages) (3750:2500:3750:1875:625)	5,625	3,750	5,625	2,813	937	18,750
Power (on HP of Machines) (6 : 3 : 5 : 1 : Nil)	10,000	5,000	8,333	1,667	–	25,000
Depreciation of M/c (on M/c Cost) (300:400:500:25:25)	12,000	16,000	20,000	1,000	1,000	50,000
Insurance of M/c (on M/c Cost) (300: 400: 500:25:25)	4,800	6,400	8,000	400	400	20,000
Direct Wages of Service Depts (at Actuals)	–	–	–	18,750	6,250	25,000
Total OH before re–apportionment	**46,175**	**48,650**	**63,208**	**38,380**	**12,337**	**2,08,750**
Add: Re–apportionment of Serv.Dept. Exps (**WN 2** below)						
S_1	8,003	12,004	16,006	(40,014)	4,001	**Nil**
S_2	6,535	3,268	4,901	1,634	(16,338)	**Nil**
Total OH (after re–apportionment)	**60,713**	**63,922**	**84,115**	**Nil**	**Nil**	**2,08,750**
Production Hours	6,225	4,050	4,100			
OH Rate per Production Hour	**9.75**	**15.78**	**20.52**			

2. Simultaneous Equations are framed and solved as under –

$S_1 = 38,380 + 10\%\ S_2$ So, $S_1 = 38,380 + \frac{1}{10} S_2$ ..... **Equation 1**

$S_2 = 12,337 + 10\%\ S_1$ So, $S_2 = 12,337 + \frac{1}{10} S_1$ ..... **Equation 2**

Put S_2 in Equation 1, we have, $S_1 = 38,380 + \frac{1}{10}(12,337 + \frac{1}{10} S_1)$

So, $S_1 = 38,380 + 1,233.7 + \frac{1}{100} S_1$ So, $S_1 - \frac{1}{100} S_1 = 38,380 + 1,233.7$ So, $\frac{99}{100} S_1 = 39,613.7$

On solving, $S_1 = 39,613.7 \times \frac{100}{99}$ **= 40,014.** Substituting in Eqn 2, we have $S_2 = 1,23,374 + \frac{1}{10}$ of (40,014) = **16,338.**

3. Computation of Total Cost of Product X

	Particulars		Rs.
	Direct Material (given)		625.00
	Direct Labour (given)		375.00
	Prime Cost		1,000.00
Add:	Overheads of Department P_1 : 5 hours × Rs.9.75	= 48.75	
	P_2 : 3 hours × Rs.15.78	= 47.34	
	P_3 : 4 hours × Rs.20.52	= 82.08	178.17
	Total Cost of Production		**1,178.17**

Illustration 11: Re–apportionment – All Methods **N 03**

E–Books is an online book retailer having 4 departments. Two sales departments are Corporate Sales & Consumer Sales. The two Support Departments are Administrative (H.R. & Accounting) & Information system. Each Sales Department conducts merchandising & marketing operations independently. The following data relate to October.

Departments	Revenues	No. of Employees	Processing time used	Cost incurred for Oct.
Corporate Sales	Rs.16,67,750	42	2,400 minutes	Rs.12,97,751
Consumer Sales	Rs. 8,33,875	28	2,000 minutes	Rs. 6,36,818
Administrative	Nil	14	400 minutes	Rs. 94,510
Information System	Nil	21	1,400 minutes	Rs. 3,04,720

The Company uses number of employees as a basis to allocate Administrative Cost, and processing time as basis to allocate Information System costs.

Required:

1. **Allocate the Support Department Costs to the Sales Department using Direct Method.**
2. **Rank the Support Departments based on percentage of their services rendered to other Support Departments. Use this ranking to allocate Support Costs based on the step down allocation method.**

3. **How could you have ranked the support departments differently?**
4. **Allocate the Support Department Cost to two Sales Departments using Reciprocal Allocation method.**

Solution: **1. Re–apportionment under Direct Method**

Particulars	Ratio / basis	Corporate Sales	Consumer Sales	Total
Overheads	given	12,97,751	6,36,818	19,34,569
Administrative Costs	No. of employees 42: 28	56,706	37,804	94,510
Information Systems	Processing time 2400: 2000	1,66,211	1,38,509	3,04,720
Total OH		**15,20,668**	**8,13,131**	**23,33,799**

2. Ranking of Service Departments

Department	Allocation Base	% of service rendered to the other Service Department
Administrative Support	No. of Employees	$\frac{21}{(42+28+21)}$ = 23.08% to Information Systems.
Information Systems	Processing Time	$\frac{400}{(2,400+2,000+400)}$ = 8.33% to Administrative Support.

Since Administrative Support renders more service to the other Service Department, i.e. Information System, it is ranked first, for Step Allocation Method.

Statement of Re–apportionment (Step Ladder Method)

Particulars	Ratio	Administrative	Info System	Corp Sales	Cons Sales	Total
Overheads	Given	94,510	3,04,720	12,97,751	6,36,818	23,33,799
Administrative Costs	42 : 28 : 21	(94,510)	21,810	43,620	29,080	Nil
Information Systems	2400:2000	–	(3,26,530)	1,78,107	1,48,423	Nil
Total OH		**–**	**–**	**15,19,478**	**8,14,321**	**23,33,799**

Note: Alternative assumptions in ranking exist. For example, Information Systems Department has more employees and processing time, hence, it may be ranked first.

3. Alternative Ranking Priority for Step Allocation Method

Department	Allocation Base	% to other Dept (from WN 2)	Cost Effect
Administrative Support	No. of Employees	23.08% to Info Systems.	23.08% × 94,510 = 21,810
Information Systems	Processing Time	8.33% to Administrative Support	8.33%× 3,04,720 = 25,383

Since Cost of service rendered by Information Systems Department is higher, it could alternatively be ranked first, for the purpose of Step Allocation Method.

4. Reciprocal Allocation method

Let X and Y be the Total Costs of Administrative Support and Information Systems respectively. Based on the above, the simultaneous equations are framed as under:

X = 94,510 + 8.33%Y. So, X = 94,510 + 0.0833Y ..... **Equation 1**

Y = 3,04,720 + 23.08%X. So, Y = 3,04,720 + 0.2308 X ..... **Equation 2**

Substituting the value of X in Equation 2, we have,

Y = 3,04,720 + 0.2308 (94,510 + 0.0833Y)

Y = 3,04,720 + 21,813 + 0.0192 Y

Y – 0.0192 Y = 3,26,533 So, 0.9808 Y = 3,26,533 So, we get, **Y = 3,32,925**

Substituting the value of Y in Equation 1, we have X = 94,510 + 0.0833 (3,32,925) = **1,22,243**

Statement of Re–apportionment (Reciprocal Services Method)

Particulars	Corp Sales	Cons Sales	Administrative	Info System	Total
Overheads	12,97,751	6,36,818	94,510	3,04,720	23,33,799
Administrative Support (42 : 28 : 21)	56,436	37,602	(1,22,243)	28,205	Nil
Information Systems (24 : 20 : 4)	1,66,457	1,38,715	27,733	(3,32,925)	Nil
Total OH	**15,20,644**	**8,13,135**	**Nil**	**Nil**	**23,33,799**

Note: Rounding Off adjustments have been carried out in OH Share of Corporate Sales Department.

4. Different bases of Recovery / Absorption

Illustration 12: Various Methods of Absorption and Job Costs **RTP**

The following figures have been extracted from the books of a manufacturing Company. All jobs pass through the Company's two Departments –

Particulars	Welding Department	Finishing Department
Material Used	Rs.60,000	Rs.50,000
Direct Labour	Rs.30,000	Rs.15,000
Factory Overheads	Rs.18,000	Rs.12,000
Direct Labour Hours	12,000 hours	5,000 hours
Machine Hours	10,000 hours	2,000 hours
The following information relates to Job 27:		
Material	Rs.1,200	Rs.100
Direct Labour	Rs.650	Rs.250
Direct Labour Hours	265 hours	70 hours
Machine Hours	255 hours	25 hours

1. **List 5 methods of absorbing factory OH by jobs, showing the rates for each Department under the methods,**
2. **Prepare a statement showing the different cost results for Job 27 under each of the methods referred to.**

Solution: **1. Determination of Overhead Recovery Rates**

Method	Welding Department	Finishing Department
1. Percentage of Direct Material	$\frac{Rs.18,000}{Rs.60,000}$ = 30% of Direct Material.	$\frac{Rs.12,000}{Rs.50,000}$ = 24% of Direct Material.
2. Percentage of Direct Labour	$\frac{Rs.18,000}{Rs.30,000}$ = 60% of Direct Labour.	$\frac{Rs.12,000}{Rs.15,000}$ = 80% of Direct Labour.
3. Percentage of Prime Cost	$\frac{Rs.18,000}{Rs.90,000}$ = 20% of Prime Cost.	$\frac{Rs.12,000}{Rs.65,000}$ = 18.46% of Prime Cost.
4. Labour Hour Rate	$\frac{Rs.18,000}{12,000\ Hours}$ = Rs.1.50 per DLH.	$\frac{Rs.12,000}{5,000\ Hours}$ = Rs.2.40 per DLH.
5. Machine Hour Rate	$\frac{Rs.18,000}{10,000\ Hours}$ = Rs.1.80 per m/c hour.	$\frac{Rs.12,000}{2,000\ Hours}$ = Rs.6.00 per m/c hour.

2. Job Cost Statement

Total Costs of Job No.27 under different methods are computed as under –

Particulars	% of Direct Material	% of Direct Labour	% of Prime Cost	Labour Hour Rate	Machine Hour Rate
Welding:					
Materials	1,200	1,200	1,200	1,200	1,200
Labour	650	650	650	650	650
Prodn OH	30%×1,200=360	60%×650 = 390	20%×1,850=370	1.50×265 = 398	1.80×255 = 459
Sub–Total	**2,210**	**2,240**	**2,220**	**2,248**	**2,309**
Finishing:					
Materials	100	100	100	100	100
Labour	250	250	250	250	250
Prodn OH	24% × 100 = 24	80%×250 = 200	18.46%×350=65	2.40 × 70 = 168	6.00 × 25 = 150
Sub–Total	**374**	**550**	**415**	**518**	**500**
Total Cost	**2,584**	**2,790**	**2,635**	**2,766**	**2,809**

Illustration 13: Choice of Method of Absorption

A Factory, which was allocating 'Overhead Expenses' to jobs on the basis of 'Prime Cost', found the resulting cost ludicrous. The Management therefore decided that overhead should be allocated either on the basis of Direct Labour Hours or Direct Labour Cost. Scrutiny of a normal week's accounts showed the following –

Factory Expenses incurred = Rs.5,000, Direct Labour Costs = Rs.2,500, Direct Labour Hours worked = 500 man-hours

Direct Cost incurred on two typical jobs:

Particulars	Job 847A	Job 848B
Direct Materials	Rs.35	Rs.35
Direct Labour Cost	Rs.4 per hour	Rs.4.50 per hour
Direct Labour Hours	8 hours	6 hours

You are requested to compute the cost of each of these two jobs on the basis of Direct Labour Cost rate and Direct Labour Hour Rate and give your views as to which of these two rates are more equitable for adoption.

Solution: **1. Computation of Recovery Rates**

Percentage of Direct Labour	Labour Hour Rate
OH Recovery Rate = $\frac{\text{Rs.5,000}}{\text{Rs.2,500}}$ = 200% of Direct Labour.	OH Recovery Rate = $\frac{\text{Rs.5,000}}{\text{500 Hours}}$ = Rs.10 per DLH.

2. Statement of Job Costs under the alternative methods

	Job 847 A		Job 848 B	
Method of Absorption Used	% of Labour	Labour Hr Rate	% of Labour	Labour Hr Rate
Direct Material	35.00	35.00	35.00	35.00
Direct Labour at Rs.4 & 4.5 per hour	32.00	32.00	27.00	27.00
Overhead (200% or Rs.10 per hr)	64.00	80.00	54.00	60.00
Total Cost	**131.00**	**147.00**	**116.00**	**122.00**

3. Conclusion: Since Wage Rates per hour and time requirement are different for these jobs, Percentage of Direct Labour is preferable than Labour Hour Rate, since it considers the effect of both time and wage rates.

5. Machine Hour Rate

Illustration 14: Comprehensive Machine Hour Rate

A machine costs Rs.3,00,000 and is deemed to have a scrap value of 5% at the end of its effective life of 19 years. Ordinarily the machine is expected to run for 2,400 hours per annum, but it is estimated that 150 hours will be lost for normal repairs and maintenance and a further 750 hours will be lost in normal shut-down.

The other details for the Machine Shop are –

Wages, Bonus and PF Contribution for each of two operators (each Operator is in charge of 2 machines)	Rs.90,000 per annum
Rent and Rates for the shop	Rs.30,000 per annum
General Lighting of the shop	Rs.2,500 per month
Quarterly Insurance Premium for the machine	Rs.2,000
Repairs and Maintenance – average – for a machine	Rs.2,500 per month
Shop Supervisor's Salary	Rs.5,000 per month
Power Consumption of machine per hour	2 units [Cost of Power = Rs.2.50 per power unit]
Other Factory Overheads attributable to the shop	Rs.40,000 per annum

Compute the Comprehensive Machine Hour Rate on the basis of the following additional information –

- **There are 4 identical machines in the Shop,**
- **The Supervisor is expected to devote 1/5th of his time towards this Shop.**

Solution:

1. Number of Productive Hrs p.a. = Total Hours **Less** Repairs and Maintenance and Shut down hours

= 2,400 – 150 – 750 = **1,500 hours** per annum.

2. Statement of Overheads per annum

Particulars	Computation	Rs.
Operators' Wages	Rs.90,000 p.a ÷ 2 machines	45,000
Rent & Rates	Rs.30,000 ÷ 4 machines	7,500
General Lighting	(Rs.2,500 per month × 12 months) ÷ 4 machines	7,500
Insurance Premium	Rs.2,000 × 4 quarters	8,000
Repairs & Maintenance	Rs.2,500 ×12 months	30,000
Shop Supervisor's Salary	Rs.5,000 × 12 months = (Rs.60,000 ×1/5th)÷ 4 machines	3,000
Power	[1,500 hours × 2 power units ×Rs.2.50]	7,500
Other Overheads	Rs.40,000 ÷ 4 machines	10,000
Depreciation	[Rs.3,00,000 ×95%] ÷ 19 years	15,000
Total Overheads		**1,33,500**

3. Machine Hour Rate = $\frac{\text{Total OH}}{\text{Effective Machine Hours}} = \frac{\text{Rs.1,33,500}}{\text{1,500 hours}}$ **= Rs.89 per machine hour.**

Illustration 15: Comprehensive Machine Hour Rate **N 08**

Calculate Machine Hour Rate for recovery of Overheads for a machine from the following information:

Cost of Machine is Rs.25,00,000 and estimated salvage value is Rs.1,00,000. Estimated working life of the Machine is 10 years. Annual working hours are 3,000 in the Factory. The Machine requires 400 hours per annum for repairs and maintenance. Setting – up time of the Machine is 156 hours per annum to be treated as productive time. Cost of Repairs and Maintenance for the whole working life of the Machine is Rs.3,50,000. Power used 15 units per hour at a cost of Rs.5 per unit. No power is consumed during the maintenance and setting – up time. A chemical required for operating the machine is Rs.9,880 per annum. Wages of an Operator is Rs.4,000 per month. The Operator devoted 1/3rd of his time to the Machine. Annual Insurance Charges 2% of cost of machine.

Light Charges for the Department is Rs.2,500 per month, having 48 points in all, out of which only 8 points are used at this Machine. Other Indirect Expenses are chargeable to the Machine are Rs.6,500 per month.

Solution: **Computation of Machine Hour Rate**

Particulars	Computation	Rs.
Depreciation	(Rs.25,00,000 – Rs.1,00,000) ÷ 10 years	2,40,000
Repairs and Maintenance	Rs.3,50,000 ÷ 10 years	35,000
Power	(3,000 – 400 – 156) × 15 units ph ×Rs.5 per unit	1,83,300
Chemical Cost	Given	9,880
Operator's Wages	Rs.4,000 × 12 months × 1/3rd	16,000
Insurance	2% on Rs.25,00,000	50,000
Lighting Charges	Rs.2,500 × 12 months × 8/48	5,000
Other Expenses	Rs.6,500 × 12 months	78,000
	Total OH	**6,17,180**
	Effective Production Hours p.a. = 3,000 – 400 =	2,600 hours
	Machine Hour Rate = $\frac{\text{Rs.6,17,180}}{\text{2,600 Hours}}$ =	**Rs.237.38**

Note: It is given that Set–Up Time is treated as part of Productive Time. Hence, OH will be absorbed at the above rate, for the total time spent on each job, i.e. Set–up Time + Operation Time.

Illustration 16: Comprehensive Machine Hour Rate **N 07**

A Machine Shop Cost Centre contains three machines of equal capacities. Three operators are employed on each machine, payable Rs.20 per hour each. The Factory works for forty–eight hours in a week which includes 4 hours set–up time. The work is jointly done by Operators. The Operators are paid fully for the forty–eight hours. In additions they are paid a bonus of 10% of productive time. Costs are reported for this Company on the basis of thirteen four–weekly period.

The Company for the purpose of computing machine hour rate includes the Direct Wages of the Operator and also recoups the Factory Overheads allocated to the machines. The following details of Factory OH applicable to the Cost Centre are available –

- **Depreciation 10% per annum on original cost of the machine. Original Cost of each machine is Rs.52,000.**
- **Maintenance and Repairs per week per machine is Rs.60.**
- **Consumable Stores per week per machine are Rs.75.**
- **Power 20 units per hour per machine at the rate of 80 paise per unit.**
- **Apportionment to the Cost Centre: Rent p.a. Rs.5,400, Heat and Light p.a. Rs.9,720, and Foreman's Salary p.a. Rs.12,960.**

Calculate – (a) Cost of running one machine for a four–week period, and (b) Machine Hour Rate.

Solution: 1. Effective Working Hours (excluding Set–Up Time) = (48 – 4) × 4 Weeks = **176 hours** for 4–week period.

2. Statement of OH for 4–weekly period

Particulars	Computation	Rs.
Operator's Wages	3 Operators × 48 hours per week × 4 weeks × Rs.20 per Hour	11,520
Operator's Bonus	10% of Wages	1,152
Depreciation	Rs.52,000 × 10% p.a. × 4/52	400
Repairs & Maintenance	Rs.60 per week × 4 weeks	240
Consumable Stores	Rs.75 per week × 4 weeks	300
Rent	Rs.5,400 × 4/52 × 1/3rd (i.e. 3 machines)	138
Heat and Light	Rs.9,720 × 4/52 × 1/3rd (i.e. 3 machines)	249
Foreman's Salary	Rs.12,960 × 4/52 × 1/3rd (i.e. 3 machines)	332
Power (including for Set–up Time)	20 units × 48 hours per week × 4 weeks × 0.80 per unit	3,072
	Total OH for 4–week period	**17,403**

3. Machine Hour Rate = $\frac{\text{Total OH}}{\text{Effective Machine Hours}} = \frac{\text{Rs.17,403}}{\text{176 hours}}$ = **Rs.98.88 per hour.**

Note: Set–up Time is not considered in calculation of Effective Machine Hours.

Illustration 17: Comprehensive Machine Hour Rate **N 05**

From the details furnished below you are required to compute a comprehensive Machine–Hour Rate –

Original Purchase Price of the machine (subject to depreciation at 10% p.a. on Original Cost)	**Rs.3,24,000**
Normal working hours for the month (The machine works to only 75% of capacity)	**200 hours**
Wages of Machineman	**Rs.125 per day (of 8 hours)**
Wages for a Helper (Machine Attendant)	**Rs.75 per day (of 8 hours)**
Power Cost for the month for the time worked	**Rs.15,000**
Supervision Charges apportioned for the machine centre for the month	**Rs. 3,000**
Electricity & Lighting for the month	**Rs. 7,500**
Repairs & Maintenance (Machine) including Consumable Stores per month	**Rs.17,500**
Insurance of Plant & Building (apportioned) for the year	**Rs.16,250**
Other General Expenses per annum	**Rs.27,500**

The workers are paid a fixed Dearness Allowance (DA) of Rs.1,575 per month. Production Bonus payable to workers in terms of an award is equal to 33.33% of Basic Wages and DA. Add 10% of the Basic Wages and DA against Leave Wages and Holidays with pay to arrive at a comprehensive labour–wage for debit to production.

Solution: 1. Effective Machine Operating Hours = 200 hours × 75% = **150 hours.**

2. Statement of Machine Hour Rate

Particulars			Rs.	Per Hour
A. Machine related Overheads				
(a) Depreciation	Fixed	(Rs.3,24,000 × 10%) ÷ 12 months	2,700	18.00
(b) Power	Variable	Given	15,000	100.00
(c) Supervision	Fixed	Given	3,000	20.00
(d) Elec. & Lighting	Variable	Given	7,500	50.00
(e) Repairs and Maint.	Variable	Given	17,500	116.67
(f) Insurance	Fixed	Rs.16,250 ÷ 12 months	1,354	9.03
(g) Other General Exps	Fixed	Rs.27,500 ÷ 12 months	2,292	15.28
Total Machine Related OH			**49,346**	**328.98**

Particulars					Rs.	Per Hour
B. Wages	Basic:	Machineman	Rs.125 × 200/8	= 3,125		
		Attendant	Rs. 75× 200/8	= 1,875		
	Dearness Allowance		Rs.1,575 × 2 workers	= 3,150		
		Sub–Total (Basic + DA)		= 8,150		
	Add:	Production Bonus at 1/3rd of above		= 2,717		
	Add:	Leave Wages and Holiday Pay at 10%		= 815	**11,682**	**77.88**
Total Overheads (including Labour Cost element)					**61,028**	**406.86**

Illustration 18: Comprehensive Machine Hour Rate – Different Time Components **M 97**

SUPER–GLOW Ltd. having 15 different types of automatic machines furnishes information as under for a year –

1. **OH Expenses: Factory Rent Rs.96,000 (Floor Area = 80,000 sq. feet). Heat and Gas Rs.45,000 and Supervision Rs.1,20,000.**
2. **Wages of the Operator are Rs.48 per day of 8 hours. He attends to one machine when it is under set–up and two machines while under operation.**
3. **In respect of machine C (one of the above machines) the following particulars are furnished –**
   - **(a) Cost of Machine Rs.45,000, Life of Machine – 10 years and scrap value at the end of its life Rs.5,000.**
   - **(b) Annual Expenses on Special Equipment attached to the machine are estimated at Rs.3,000.**
   - **(c) Estimated Operation Time of the Machine is 3,600 hours while set up time is 400 hours per annum.**
   - **(d) The machine occupies 5,000 sq.ft. of floor area.**
   - **(e) Power Costs Rs.8 per hour while the machine is in operation.**

Find out the Comprehensive Machine Hour Rate.

Solution:

Note: There are 2 time–components, viz. Set–up time and Operation time. Power and Operator's wages are different for these two components. So, OH are classified as – (a) General OH, i.e. those relatable to Total Time, and (b) Special OH, i.e. those relatable to only a portion of time or those which differ for two different time components. OH Rate per hour is found out first for General OH. Thereafter, special items are considered on a per–hour basis.

1. Computation of General Overhead Rate per hour

Particulars		Computation	Rs.
Rent	(Based on Area)	$\text{Rs.96,000} \times \frac{500}{8,000}$	6,000
Heat and Gas	(Based on Number of Machines)	$\frac{\text{Rs.45,000}}{\text{15 Machines}}$	3,000
Supervision	(Based on Number of Machines)	$\frac{\text{Rs.1,20,000}}{\text{15 Machines}}$	8,000
Depreciation	(Direct Allocation of Cost)	[Rs.45,000 – Rs.5,000] ÷ 10 years	4,000
Special Equipment	(Direct Allocation of Cost)	Given	3,000
Total General Overheads		**(all fixed in nature)**	**24,000**

- Since these expenses relate to the total time, i.e. whether or not the machine is under operation, the relevant hours for which these are incurred are 3,600 + 400 = 4,000 machine hours.
- Hence General Overhead Rate per hour = Rs.24,000 ÷ 4,000 machine hours = **Rs.6 per hour.**

2. Computation of Comprehensive Machine Hour Rates per hour

Component of Time		Set up	Operation
	General Overhead per hour as above	6.00	6.00
Add:	Power Cost per hour (only during operation)	–	8.00
Add:	Operator's Wages (Rs.48 ÷ 8 hours =Rs.6 per hour)	(Rs.6 ÷ 1 machine) 6.00	(Rs.6 ÷ 2 machines) 3.00
Comprehensive Machine Hour Rate		**12.00**	**17.00**

Note: In the above case, OH will be absorbed to various jobs at the specific rates, i.e. (Set–up Time × Rs.12 ph) + (Operation Time × Rs.17 ph).

Illustration 19: Comprehensive Machine Hour Rate – Different Time Components

In RARELY–IDLE Ltd, Machine Hour Rate is worked out at the beginning of the year on the basis of 13–week period, which is equivalent to 3 calendar months. The following estimates for operating a machine are provided to you.

1. **Total available working hours per week: 48 hours**
2. **Maintenance Time included in above: 2 hours**
3. **Setting–up Time included in above: 2 hours**
4. **Operator's Wages per month: Rs. 6,500**
5. **Supervisor's Salary per month: Rs. 15,000 (Common Supervisor for 3 machines)**
6. **WDV of machine Rs.1,80,000 (depreciation at 10% p.a.)**
7. **Repairs and Maintenance per annum: Rs. 16,000**
8. **Consumable Stores per annum: Rs. 30,000**
9. **Rent & Rates for the quarter (apportioned): Rs. 5,000**

Power is consumed at the rate of 10 units per hour at the rate of Rs.2.50 per unit. Power is required for productive hours only. Setting–up time is part of productive time, but no power is required for setting–up jobs.

The Operator & Supervisor are permanent. Repairs & Maintenance and Consumable Stores are variable. You are required to determine the machine hour rate.

Solution: **1. Computation of Productive Machine Hours**

	Possible Operating Hrs = [48 – 2 – 2] × 13 weeks	572 Operating Hours
Add:	Set Up Hours = 2 × 13 weeks	26 Set Up Hours
	Hence Productive Hours	598 Productive Machine Hours

2. Statement of Overheads for the 13–week period

Particulars	Computation	Rs.
Operators' Wages	Rs.6,500 ×3 months	19,500
Supervisor's Salary	Rs.15,000 × 3 months ×1/3 machines	15,000
Depreciation	Rs.1,80,000 ×10% ×13/52 weeks	4,500
Repairs and Maintenance	Rs.16,000 ×13/52 weeks	4,000
Consumables	Rs.30,000 ×13/52 weeks	7,500
Rent, Rates and Taxes	Given	5,000
Total Overheads	**(excluding Power)**	**55,500**

These OH relate to total time of 598 hours. Hence, General OH Rate per hour = Rs.55,500 ÷ 598 Hrs = **Rs.92.81 per hour.**

3. Computation of Comprehensive Machine Hour Rates

Component of Time		Set up	Operation
	General Overhead per hour as above	92.81	92.81
Add:	Power Cost per hour = 10 units ×Rs.2.50 per unit	–	25.00
Total Machine Hour Rate		**92.81**	**117.81**

Note: However, where Set–up Time cannot be separately charged to Jobs, the Machine Hour Rate should be based on Operating Hours only. In such case, Machine Hour Rate will be as under –

	Total OH as above	Rs.55,500
Add:	Power Cost = 10 units ×Rs.2.50 per unit × 572 hours	Rs.14,300
	Total OH (including Power)	**Rs.69,800**
	Operating Hours per month	572 hours
	Machine Hour Rate	**Rs.122.03 per operating hour**

Note: By an alternative calculation procedure, Operators' Wages, Supervisors' Salary, Depreciation, Rent and Rates can be related to 598 productive hours, while Consumables, Repairs & Maintenance, and Power cost can be related to 572 hours.

Illustration 20: Machine Hour Rate – with Set Up Time considered Unproductive vs Productive **M 05**

A manufacturing unit has purchased and installed a new machine of Rs.12,70,000 to its fleet of 7 existing machines. The new machine has an estimate life of 12 years and is expected to realise Rs.70,000 as scrap at the end of its working life. Other relevant data are as follows –

1. **Budgeted working hours are 2,592 based on 8 hours per day for 324 days. This includes 300 hours for Plant Maintenance and 92 hours for setting up of Plant.**
2. **Estimated Cost of maintenance of the machine is Rs.25,000 p.a.**
3. **The machine requires a special chemical solution, which is replaced at the end of every week (6 days in a week) at a cost of Rs.400 each time.**
4. **Four Operators control operation of 8 machines and the average wages per person amounts to Rs.2,420 per week plus 15% Fringe Benefits.**
5. **Electricity used by the machine during production is 16 units per hour at a cost of Rs.3 per unit. No current is taken during maintenance and set up.**
6. **Departmental and General Works Overhead allocated to the operation during last year was Rs.50,000. During the current year, it is estimated to increase by 10% of this amount.**

Calculate the Machine Hour Rate, if – a) setting up time is unproductive, (b) setting up time is productive.

Solution: **1. Statement of OH Costs relating to the new machine**

Particulars	Computation	Rs.
(a) Depreciation of Machine	(Rs.12,70,000 – Rs.70,000) ÷ 12 years	1,00,000
(b) Maintenance Costs	Given	25,000
(c) Special Chemical Solution Costs	(324 ÷ 6) = 54 weeks × Rs.400	21,600
(d) Operators' Wages and Fringe Benefits	$\frac{\text{(Rs.2,420 × 4 Operators × 54 weeks × 115\%)}}{\text{8 machines}}$	72,358
(e) Power Cost	(2,592 – 392) × 16 units × Rs.3 per unit	1,05,600
(e) Allocated General Works OH	$\frac{\text{(Rs.50,000 + 10\% thereon)}}{\text{8 machines}}$	6,875
Total Overheads		**3,31,433**

2. Computation of Machine Hour Rate

If Setting up time is	Unproductive	Productive
(a) Effective Machine Hours	2,592 – 392 = 2,200 machine hours	2,592 – 300 = 2,292 machine hours
(b) Machine Hour Rate	$\frac{\text{Rs.3,31,433}}{\text{2,200 Hours}}$ **=Rs.150.65 per hour**	$\frac{\text{Rs.3,31,433}}{\text{2,292 Hours}}$ **=Rs.144.60 per hour**

Illustration 21: Machine Hour Rate – with special facility – Expenses of Crane – with and without use of Crane

In a Factory there are three machines A, B and C. The expenses allocated to these machines are A: Rs.63,900, B: Rs.60,700 and C: Rs.95,100. In addition, there is an Overhead Crane to bring materials to the machines as necessary. The expenses allocated to this Crane are Rs.57,000.

During the period of this expenditure, the machines were used as follows –

Particulars	Machine A (in Hrs)	Machine B (in Hrs)	Machine C (in Hrs)
With use of Crane	160	130	480
Without use of Crane	428	577	–
Total	588	707	480

Calculate a Machine Hour Rate for each machine, distinguishing between the hours in which the crane is used and those in which it is not.

Solution: **Computation of Machine Hour Rate**

Particulars	M/c A	M/c B	M/c C	Crane
Overheads (given)	Rs.63,900	Rs.60,700	Rs.95,100	Rs.57,000
Operating hours (given)	588	707	480	160+130+480 = 770
Rate per hour (without use of Crane)	$\frac{\text{Rs.63,900}}{\text{588 Hrs}}$ = **Rs.108.67 ph**	$\frac{\text{Rs.60,700}}{\text{707 Hrs}}$ = **Rs.85.86 ph**	$\frac{\text{Rs.95,100}}{\text{480 Hrs}}$ = **Rs.198.13 ph**	$\frac{\text{Rs.57,000}}{\text{770 Hrs}}$ = **Rs.74.03 ph**
Rate per hour (with use of Crane)	= 108.67 + 74.03 **=Rs.182.70 ph**	= 85.86 + 74.03 **=Rs.159.89 ph**	= 198.13 + 74.03 **=Rs.272.16 ph**	

Note: M/c related OH is divided by Machine Operating Hours, to derive Normal OH Rate per hour (i.e. without use of Crane). OH Rate (with use of Crane) = OH Rate without use of Crane + Average Cost of Crane per hour.

6. Treatment of Absorption Differences

Illustration 22: Treatment of Underabsorption – Journal Entries **RTP, N 83**

Your Company uses an integrated accounting system and applies overheads on the basis of "pre–determined" rates. The following figures are extracted from the Trial Balance as at 31st March.

- **Manufacturing OH Rs.4,26,544 Dr.**
- **Manufacturing OH applied Rs.3,65,904 Dr.**
- **Work–in–Progress Rs.1,41,480 Dr.**
- **Finished Goods Stock Rs.2,30,732 Dr.**
- **Cost of Goods Sold Rs.8,40,588 Dr.**

You are required to show the profit implications of treating under–absorption under the following methods –

1. **Write off to Profit and Loss Account,**
2. **Adjustment to Cost of Sales and Inventories of WIP and Finished Goods.**

Solution: Difference in Absorption = Absorbed OH **Less** Actual OH

= Rs.3,65,904 – Rs.4,26,544 = **Rs.60,640 (Underabsorption)**

This difference may be dealt with under any of the alternative methods –

Method 1: Transfer all differences to Costing Profit and Loss Account

Journal Entry	Effect on Profits
P & L A/c Dr. Rs.60,640 To Factory OH Control Rs.60,640	Profits for the current period are reduced by Rs.60,640.

Method 2: Treat difference as normal using Supplementary OH Recovery Rate

Journal Entry	Effect on Profits
Cost of Sales A/c Dr. Rs.42,029 FG Control A/c Dr. Rs.11,537 WIP Control A/c Dr. Rs. 7,074 To Factory OH Control A/c Rs.60,640	Profits for the current period are reduced by Rs.42,029. Balance underabsorption (i.e. Rs.11,537 + Rs.7,074) is included in value of FG and WIP Inventory, and the effect thereof is carried over to subsequent accounting period.

Note: Under Method 2, the underabsorbed overheads are apportioned to Units Sold, Finished Goods Stock and WIP Stock, on the basis of value in the ratio Rs.8,40,588: 2,30,732: 1,41,480. (Alternatively, if quantity information is available, OH can be apportioned in the ratio of quantities also).

Alternative Method 3: Carry forward of all under–absorbed Overheads to subsequent year

Treatment	Effect on Profits
The entire amount of Under–absorbed Overhead may be carried forward to the next year if it is presumed that such under–absorption has arisen due to cyclical or seasonal fluctuations.	In such case, Profit of the current year will then be based on pre–determined overheads and **remain unaffected**.

Illustration 23: Treatment of under–absorption **N 95 adapted**

In a manufacturing unit, Overhead was recovered at a pre–determined rate of Rs.20 per labour hour. The total Factory OH paid and the labour–hours actually worked were Rs.45,00,000 and 2,00,000 labour–hours respectively. During this period 30,000 units were sold. At the end of the period 5,000 units were held in stock while there was no Opening Stock of Finished Goods. Similarly, though there was no stock of uncompleted units at the beginning of the period, at the end of the period there were 10,000 uncompleted units, which may be reckoned at 50% complete.

The Cost Accountant was able to obtain the following other information –

1. **Actual Factory OH included the following items –**
   - **(a) Rs.1,25,000 paid to workers for strike period, under an award of the Labour Court.**
   - **(b) Rs.25,000 being penalty paid for contravention of Central Excise Rules.**
   - **(c) Rs.40,000 being obsolete stores now written off.**
   - **(d) Rs.10,000 paid towards Consumables, relating to prior periods, now paid after settlement of dispute.**
2. **Rs.2,00,000 of Factory OH for the period was still payable and not yet accounted in the books.**

On analysing the reasons, it was found that 60% of the Unabsorbed OH were due to defective planning and rest were attributable to increase in OH costs. How would Unabsorbed OH be treated in cost accounts?

Solution: **1. Difference in Absorption** = Absorbed OH **Less** Actual OH

= (2,00,000 DLH × Rs.20 per hour) **Less** (45,00,000 paid + 2,00,000 payable)

= Rs.7,00,000 (Underabsorption)

Normal Increase in OH Costs

Total Rs.7,00,000 – Abnormal Rs.5,00,000

= **Rs.2,00,000**

Treated as **COST** and apportioned to

Units Sold	Closing Stock of Fin. Goods	Closing Stock of WIP
30,000 units	5,000 units	(10000× 50%)= 5,000 units
Rs.1,50,000	Rs.25,000	Rs.25,000

So, **Supplementary OH Recovery Rate** = **Rs.5 per unit.**

Abnormal Items	**Rs.**
1. Strike Period Wages	1,25,000
2. Penalty under Excise Law	25,000
3. Obsolete Stores w/off	40,000
4. Disputed item, now paid	10,000
5. Defective Planning = 60% of (Rs.7,00,000 – Total of Items 1 to 4)	3,00,000
Total of above	**5,00,000**

Treated as **LOSS** and debited to Costing P & L

Notes:

- In respect of Closing Stock of WIP, only 50% is complete. Hence, Deemed 100% complete units, i.e. Equivalent Production is taken for apportionment of Normal OH Underabsorption.
- Supplementary OH Recovery Rate = $\frac{\text{Total OH}}{\text{Total Output Qtty}} = \frac{\text{Rs.1,50,000}}{\text{30,000 units}}$ = Rs.5 per unit.

This calculation can be based on either Units Sold, (or) Closing Stock of FG, (or) Closing Stock of WIP, (or) Total of all these.

2. Journal Entries

Transaction / Narration	Particulars	Dr.	Cr.
1. Production OH incurred	Production OH Control A/c Dr.	Rs.47,00,000	
	To General Ledger Adjustment A/c		Rs.47,00,000
2. Production OH absorbed	WIP Control A/c Dr.	Rs.40,00,000	
	To Production OH Control A/c		Rs.4000,000
3. Treatment of Underabsorption	Cost of Sales A/c Dr.	Rs.1,50,000	
	Finished Goods Control A/c Dr.	Rs. 25,000	
	WIP Control A/c Dr.	Rs. 25,000	
	Costing P&L A/c Dr.	Rs.5,00,000	
	To Production OH Control A/c		Rs.7,00,000

3. Impact on Profit

- OH absorbed into production is only Rs.40,00,000 whereas OH actually incurred is Rs.47,00,000. Hence, **before** passing the Journal Entry for underabsorption, profits would have been wrongly over–stated (due to under–absorption / under–statement of costs) by Rs.7,00,000.
- The above wrong over–statement of profits is **rectified** by the Underabsorption entry, in the following manner –

Underabsorption Amount, (i.e. Profit over–statement amount) = Rs.7,00,000

Transfer to	**Cost of Sales A/c**	**FG Control A/c**	**WIP Control A/c**	**Costing P&L A/c**
Amount Transfer	Rs.1,50,000	Rs.25,000	Rs.25,000	Rs.5,00,000
Treatment	Finally transferred to Costing P&L A/c	Included in Value of Closing Stock of FG	Included in Value of Closing Stock of WIP	Transferred to Costing P&L A/c

Profits of next period will be reduced by Rs.50,000, since Opening Stock will be valued at higher amount.

Profits of current period will be reduced by Rs.6,50,000

7. Miscellaneous Illustrations

Illustration 24: Apportionment of Selling Expenses

APPORTION Ltd produces a single product in three sizes A, B and C. Prepare a statement showing the Selling and Distribution Expenses apportioned over these three sizes applying the appropriate basis for such apportionment in each case from the particulars indicated. Express the total of the costs so apportioned to each size as: (1) Cost per unit sold – (nearest paise,) and (2) Percentage of Sales turnover (nearest two places of decimal). The expenses are as under –

Expenses	Rs.	Basis of Apportionment
Salesmen Salaries	10,000	Direct Charges
Sales Commission	6,000	Sales Turnover
Sales Office Expenses	2,096	Number of orders
Advertising General	5,000	Sales Turnover
Advertising Specific	22,000	Direct Charges
Packing Expenses	3,000	Total Volume in cubic feet of produces sold
Delivery Expenses	4,000	Total Volume in cubic feet of produces sold
Warehouse Expenses	1,000	Total Volume in cubic feet of produces sold
Credit Collection Expenses	1,296	Number of orders

Data available relating to the three sizes are as follows –

Particulars	Total	A	B	C
Number of Salesmen (all paid same Salary)	10	4	5	1
Units sold	10,400	3,400	4,000	3,000
Number of Orders	1,600	700	800	100
Percentage of Specific Advertising	100%	30%	40%	30%
Sales Turnover	Rs.2,00,000	Rs.58,000	Rs.80,000	Rs.62,000
Volume in cu. ft. per unit of finished product	–	5	8	17

Solution: **1.** Total Volume in Cubic Feet of Produces sold is calculated as under –

Product	A	B	C
Units sold	3,400	4,000	3,000
Volume in cubic feet per unit	5	8	17
Total volume in Cubic feet of produces sold	17,000	32,000	51,000

2. Statement of Apportionment of Selling and Distribution Overheads (amounts in Rs.)

Particulars	Basis	Total	A	B	C
Salesman Salaries	Number of Salesmen (4 : 5 : 1)	10,000	4,000	5,000	1,000
Sales Commission	Sales Turnover (58 : 80 : 62)	6,000	1,740	2,400	1,860
Sales Office Expenses	Number of Orders (7 : 8 : 1)	2,096	917	1,048	131
Advertisement General	Sales Turnover (58 : 80 : 62)	5,000	1,450	2,000	1,550
Advertisement Specific	Given Percentage (30 : 40 : 30)	22,000	6,600	8,800	6,600
Packing	As per **WN 1** above (17 : 32 : 51)	3,000	510	960	1,530
Delivery Expenses	As per **WN 1** above (17 : 32 : 51)	4,000	680	1,280	2,040
Warehouse Expenses	As per **WN 1** above (17 : 32 : 51)	1,000	170	320	510
Cr. Collection Expenses	Number of Orders (7 : 8 : 1)	1,296	567	648	81
Total Overheads		**54,392**	**16,634**	**22,456**	**15,302**
No. of units sold		10,400	3,400	4,000	3,000
Cost per unit sold	Total OH ÷ Number of Units Sold	**5.23**	**4.89**	**5.61**	**5.10**
Sales Turnover		2,00,000	58,000	80,000	62,000
Cost as % of Turnover	Total OH ÷ Sales Turnover	**27.20%**	**28.68%**	**28.07%**	**24.68%**

Illustration 25: Overheads Apportionment to Products **N 83**

A Company manufactures building bricks and firebricks. Both products require two processes – (a) Brick forming & (b) Heat-treating. The time required for the two bricks and other particulars are given below –

Particulars	Building Bricks	Fire Bricks
Forming per 100 bricks	3 hours	2 hours
Heat Treatment per 100 bricks	2 hours	5 hours
Production during the month	1,30,000 units	70,000 units

The total costs of the two departments for the month were Forming Rs.21,200 and Heat Treatment Rs.48,800. Prepare a Statement of Manufacturing Costs for the two varieties of bricks.

Solution: **1. Manufacturing Cost Statement**

	Building Bricks					Fire Bricks				
Process	**Time per 100 nos.**	**Time for 1,30,000 units**	**Rate p.h. (WN 2)**	**Total Cost for 1,30,000 units**	**Cost per 100 nos.**	**Time per 100 nos.**	**Time for 70,000 units**	**Rate p.h. (WN 2)**	**Total Cost for 70,000 units**	**Cost per 100 nos.**
Brick forming	3 hours	3,900 hrs	Rs.4	Rs.15,600	Rs.12	2 hours	1,400 hrs	Rs.4	Rs.5,600	Rs.8
Heat treating	2 hours	2,600 hrs	Rs.8	Rs.20,800	Rs.16	5 hours	3,500 hrs	Rs.8	Rs.28,000	Rs.40
		6,500 hrs		Rs.**36,400**	**Rs.28**		4,900 hrs		Rs.**33,600**	**Rs.48**

2. Computation of OH Rates per Hour

(a) **Brick Forming:** Rate ph = $\frac{\text{Total Costs}}{\text{Total Hours}} = \frac{\text{Rs.21,200}}{\text{(3,900+1,400) hours}}$ **= Rs.4 p.h.**

(b) **Heat Treating:** Rate ph = $\frac{\text{Total Costs}}{\text{Total Hours}} = \frac{\text{Rs.48,800}}{\text{(2,600+3,500) hours}}$ **= Rs.8 p.h**

Note: **Alternative Method for Cost Apportionment**

Brick Forming: Divide Total Costs Rs.21,200 for each type of brick in the ratio of hours, i.e. 39: 14 as below –

Cost of Building Bricks = $21,200 \times \frac{39}{53}$ = Rs.15,600, Cost of Fire Bricks = $21,200 \times \frac{14}{53}$ = Rs.5,600.

Heat Treatment: Divide Total Costs Rs.48,800 for each type of brick in the ratio of hours, i.e.26:35 as below –

Cost of Building Bricks = $48,800 \times \frac{26}{61}$ = Rs.20,800, Cost of Fire Bricks = $48,800 \times \frac{35}{61}$ = Rs.28,000.

Illustration 26: Overhead Absorption and Performance Report N 93

Amarnath Ltd manufactures two products A and B. The manufacturing division consists of two Production Departments P_1 and P_2 and two Service Departments S_1 and S_2.

Budgeted Overhead Rates are used in the Production Departments to absorb Factory Overheads to the products. The rate of Department P_1 is based on Direct Machine Hours, while the rate of Department P_2 is based on Direct Labour Hours. In applying overheads, the pre-determined rates are multiplied by actual hours.

For allocating the Service Department Costs to Production Departments, the basis adopted is as follows –

- **Cost of Department S_1 to Departments P_1 and P_2 equal, and**
- **Cost of Department S_2 to Departments P_1 and P_2 in the ratio of 2: 1 respectively.**

The following budgeted and actual data are available – **ANNUAL PROFIT PLAN DATA**

- **Budgeted Factory OH:**

Department	P_1	P_2	S_1	S_2
Factory OH budgeted for the year	Rs.25,50,000	Rs.21,75,000	Rs.6,00,000	Rs.4,50,000

- **Budgeted output in units:** Product A – 50,000, Product B – 30,000.
- **Budgeted Raw-Material Cost per unit:** Product A – Rs.120 Product B – Rs.150.
- **All materials are used in Department P_1 only.**
- **Average Wage Rates budgeted in Dept P_2** Product A – Rs.72 p.h. Product B – Rs.75 p.h.
- **Budgeted time required for production per unit:**

	Product A	Product B
Department P_1:	1.5 Machine Hours	1.0 Machine Hour
Department P_2:	2 Direct Labour Hours	2.5 Direct Labour Hours

ACTUAL DATA: (FOR THE MONTH OF JULY)

- **Units actually produced:** Product – A – 4,000 units, Product– B 3,000 units.
- **Actual Direct Machine Hours worked in Dept P_1:** On Product A – 6,100 hours, Product B – 4,150 hours.
- **Actual Direct Labour Hours worked in Dept P_2:** On Product A – 8,200 hours, Product B – 7,400 hours.
- **Direct Costs actually incurred are as under –**

	Product A	Product B
▪ Materials	Rs.4,89,000	Rs.4,56,000
▪ Wages	Rs.5,91,900	Rs.5,52,000

- **Overheads actually incurred are –**

Department	P_1	P_2	S_1	S_2
OH incurred in July	Rs.2,31,000	Rs.2,04,000	Rs.60,000	Rs.48,000

Required:

1. **Compute the Pre–Determined Overhead Rate for each Production Department.**
2. **Prepare a Performance Report for July, that will reflect the Budgeted Costs and Actual Costs.**

Solution: 1. Computation of Machine Hours and Labour Hours for recovery purposes

Particulars	Product A	Product B	Total
(a) Budgeted output p.a. (in units) (given)	50,000	30,000	
Budgeted Machine Hours in P_1	(50,000 × 1.5 hrs) = 75,000	(30,000 × 1 hr) = 30,000	1,05,000
Budgeted Labour Hours in P_2	(50,000 × 2 hrs) = 1,00,000	(30,000 × 2.5 hrs) = 75,000	1,75,000
(b) Actual output (in units) (given)	4,000	3,000	
Actual Machine Hours utilised in P_1 (given)	6,100	4,150	10,250
Actual Labour Hours utilised in P_2 (given)	8,200	7,400	15,600

2. Computation of pre–determined OH recovery rates

Particulars	P_1	P_2	S_1	S_2
Budgeted Factory OH for the year	25,50,000	21,75,000	6,00,000	4,50,000
Allocation of S_1's Costs over P_1 & P_2 equally	3,00,000	3,00,000	(6,00,000)	–
Allocation of S_2's Costs over P_1 & P_2 in the ratio 2: 1	3,00,000	1,50,000	–	(4,50,000)
Total OH	**31,50,000**	**26,25,000**	**Nil**	**Nil**
Budgeted Operating Hours **(WN 1a)**	1,05,000 m/c hours	1,75,000 DLH	—	—
Budgeted Overhead Rates	**Rs.30 per m/c hour**	**Rs.15 per DLH**		

3. Computation of Actual Overhead Rates for each Production Department from actual data

Particulars	P_1	P_2	S_1	S_2
Actual Factory OH for the month	2,31,000	2,04,000	60,000	48,000
Allocation of S_1's Costs over P_1 & P_2 equally	30,000	30,000	(60,000)	–
Allocation of S_2's Costs over P_1 & P_2 in the ratio 2:1	32,000	16,000	–	(48,000)
Total OH	**2,93,000**	**2,50,000**	**Nil**	**Nil**
Actual Operating Hours **(WN 1b)**	10,250 m/c hours	15,600 DLH	—	—
Actual Overhead Rates	**Rs.28.59 per m/c hr**	**Rs.16.02 per DLH**		

4. Computation of Actual OH absorbed (based on Actual OH recovery rates computed in WN 3)

Particulars	Product A	Product B
Department P_1	6,100 hrs. × Rs.28.59 = Rs.1,74,400	4,150 hrs. × Rs.28.59 = Rs.1,18,649
Department P_2	8,200 hrs. × Rs.16.02 = Rs.1,31,364	7,400 hrs. × Rs.16.02 = Rs.1,18,548

5. Performance Report for July (4,000 & 3,000 units of Pdts A and B respectively were actually produced)

Particulars		Budgeted	Actual
Raw Materials used in Department P_1:	A: 4,000 units × Rs.120	4,80,000	4,89,000
	B: 3,000 units × Rs.150	4,50,000	4,56,000
Direct Labour (for DLH worked in Dept. P_2)	4,000 × 2 hrs. × Rs.72	5,76,000	5,91,900
	3,000 × 2.5 hrs. × Rs.75	5,62,500	5,52,000
Overhead Absorbed (based on M/c hours in Dept. P_1)	A: 4,000×1.5 hrs× Rs.30 & WN 4	1,80,000	1,74,400
	B: 3,000×1 hr × Rs.30 & WN 4	90,000	1,18,649
Overhead Absorbed (based on DLH in Dept. P_2)	A: 4,000 × 2 hrs. × Rs.15 & WN 4	1,20,000	1,31,364
	B: 3,000×2.5 hrs. × Rs.15 & WN 4	1,12,500	1,18,548
Total Cost		**25,71,000**	**26,31,861**

Note: One more column may be added to show the difference in cost, i.e. increase or decrease.

Illustration 27: Profit Statement under Absorption Costing – Equivalent Production **RTP**

A new Subsidiary of a Group of Companies was established for manufacture and sale of Product "Super". During the first year of operations, 90,000 units were sold at Rs.20 per unit. At the end of the year, the Closing Stocks were 8,000 units in Finished Goods Store and 4,000 units in Work-in-Progress, which were complete as regards material content but only half complete as to Labour and Overheads. Assume no Opening Stocks.

The WIP account had been debited during the year with the following costs –

- **Direct Materials Rs.7,14,000**
- **Direct Labour Rs.4,00,000**
- **Variable Overheads Rs.1,00,000**
- **Fixed Overheads Rs.3,50,000**

Selling and Administration Costs for the year were as under –

Particulars	Variable Cost per unit sold	Fixed Costs
Selling	Rs.1.50	Rs.2,00,000
Administration	Rs.0.10	Rs. 50,000

The Accountants of the Subsidiary Company had prepared a Profit Statement on the absorption costing principle, which showed a profit of Rs.11,000. You are required to –

1. **Prepare a statement showing the equivalent units produced and the cost of production of one unit of Product "Super" by element of cost and in total,**
2. **Prepare a profit statement on absorption costing principle, which agrees with the Accountant's Statement.**

Solution:

1. Statement of Equivalent Production

Particulars	Actual Units	Materials		Labour and Overheads	
		% of Completion	Equi. Units	% of Completion	Equi. Units
1. Units Sold	90,000	100%	90,000	100%	90,000
2. Finished Goods Stock	8,000	100%	8,000	100%	8,000
3. WIP Stock	4,000	100%	4,000	50%	2,000
Total	**1,02,000**		**1,02,000**		**1,00,000**

2. Statement of Cost per Equivalent Unit

Cost Element	Cost	Equivalent Units	Cost per Equi. Unit
Direct Materials	Rs. 7,14,000	1,02,000	Rs. 7.00
Direct Labour	Rs. 4,00,000	1,00,000	Rs. 4.00
Variable Overheads	Rs. 1,00,000	1,00,000	Re. 1.00
Fixed Overheads	Rs. 3,50,000	1,00,000	Rs. 3.50
Total	**Rs.15,64,000**	—	**Rs.15.50**

3. Valuation of Closing Stocks under Absorption Costing

Item	Material	Labour	Variable OH	Fixed OH	Total Cost
FG Stock	8,000 × Rs.7.00 = Rs.56,000	8,000 × Rs.4.00 = Rs.32,000	8,000 × Re.1.00 = Rs.8,000	8,000 × Rs.3.50 = Rs.28,000	Rs.1,24,000
WIP Stock	4,000 × Rs.7.00 = Rs.28,000	2,000 × Rs.4.00 = Rs.8,000	2,000 × Re.1.00 = Rs.2,000	2,000 × Rs.3.50 = Rs.7,000	Rs. 45,000

4. Profit and Loss Account for the year (under Absorption Costing)

Particulars			Rs.	Particulars	Rs.
To Direct Materials			7,14,000	By Sales (90,000 × Rs.20)	18,00,000
To Direct Labour			4,00,000	By Closing Stocks –	
To Variable POH			1,00,000	Finished Goods	1,24,000
To Fixed POH			3,50,000	Work-in-Progress	45,000
To Gross Profit c/d			**4,05,000**		
Total			**19,69,000**	**Total**	**19,69,000**
To Selling OH	– Fixed	2,00,000		By Gross Profit b/d	4,05,000
	–Variable (90,000 × 1.50)	1,35,000	3,35,000		
To Admin OH	– Fixed	50,000			
	–Variable (90,000 × 0.10)	9,000	59,000		
To Net Profit			**11,000**		
Total			**4,05,000**	**Total**	**4,05,000**

Illustration 28: Use of Blanket & Departmental Rates **RTP (adapted)**

ABC Ltd manufactures two products A and B. The Company had budgeted Factory OH of Rs.3,40,000 and budgeted DLH of 2,00,000 hours. So, the OH recovery rate was pre-determined at Rs.1.70 per DLH, and used by the Company for Product Costing purposes. The department-wise break-up of the OH and DLH were –

Particulars	Department X	Department Y	Total
Budgeted OH	Rs.2,40,000	Rs.1,00,000	Rs.3,40,000
Budgeted DLH	1,00,000 hours	1,00,000 hours	2,00,000 hours
Rate per DLH	Rs.2.40	Re.1.00	Rs.1.70 (plant-rate)

- **Each unit of Product A requires 4 hours in Department X and 1 hour in Department Y. Also, each unit of Product B requires 1 hour in Department X and 4 hours in Department Y.**
- **This was the first year of the Company's operations. There was no WIP at the end of the year. However, 2,000 and 6,000 units of Products A and B were on hand at the end of the year.**
- **You are informed that the Budgeted Activity was attained.**

1. **Determine the production and sales quantities for the above year.**
2. **Ascertain the effect of using a blanket rate, instead of Department-wise OH rates, on the Company's income.**
3. **Assume that Material and Labour Costs per unit of Product A and B were Rs.10 and Rs.15 respectively and the Selling Price is fixed by adding 40% to cover Profit and Selling and Administration OH. Calculate the difference in the Selling Price due to the use of plant-wise OH rate, instead of Department-wise OH rates?**

Solution: **1. Computation of Production and Sales Quantities**

(a) Conditions

The products' processing times are as under –

Product	A	B	Time available
Department X	4 hours	1 hour	1,00,000 hours
Department Y	1 hour	4 hours	1,00,000 hours

(b) Equations

Let A and B be the number of units (production quantities) of the two products. Converting these into equations, we have –

4A + B = 1,00,000 & **A + 4B = 1,00,000**

Solving the above, we get A = 20,000, B = 20,000

Hence, the Production and Sales Quantities are determined as under –

Product	Production Quantity	Closing Stock (given)	Balance Sales Quantity
A	20,000 units	2,000 units	18,000 units
B	20,000 units	6,000 units	14,000 units

2. Effect of using Plant-wise Rate on the Company's Profit

Product	Clg Stock Quantity	OH included using		Difference in OH
		Plant Rate	Department Rates	
A	2,000 units	2,000 × 5 hrs × 1.70 = Rs.17,000	X: 2,000 × 4 hrs × 2.40 = Rs.19,200 Y: 2,000 × 1 hr × 1.00 = Rs. 2,000	– Rs. 4,200
B	6,000 units	6,000 × 5 hrs × 1.70 = Rs.51,000	X: 6,000 × 1 hr × 2.40 = Rs.14,400 Y: 6,000 × 4 hrs × 1.00 = Rs.24,000	+ Rs.12,600
Total		**Rs.68,000**	**Rs.59,600**	**+ Rs. 8,400**

Due to the use of Plant-wise overall rate, the Company's income would be affected by Rs.8,400.

Note: Profit would be affected **only** to the extent of OH contained in Closing FG and Closing WIP if any.

3. Effect of using Plant-wise Rate on the Products' Selling Prices

Particulars	If Plant-wise Recovery Rate is used		If Department-wise Rates are used	
	Product A	Product B	Product A	Product B
Matls & Labour	Rs.10.00	Rs.15.00	Rs.10.00	Rs.15.00
(+) Production OH	5×1.70 = Rs. 8.50	5×1.70 = Rs. 8.50	4×2.40 = Rs. 9.60 1×1.00 = Re. 1.00	1 × 2.40 = Rs. 2.40 4 × 1.00 = Rs. 4.00
Cost of Prodn	Rs.18.50	Rs.23.50	Rs.20.60	Rs.21.40
(+) 40% Margin	Rs. 7.40	Rs. 9.40	Rs. 8.24	Rs. 8.56
Selling Price	**Rs.25.90**	**Rs.32.90**	**Rs.28.84**	**Rs.29.96**
Effect of using Plant-wise Rates on Product Selling Prices			Rs.2.94 **underpriced**	Rs.2.94 **overpriced**