

Material Costing

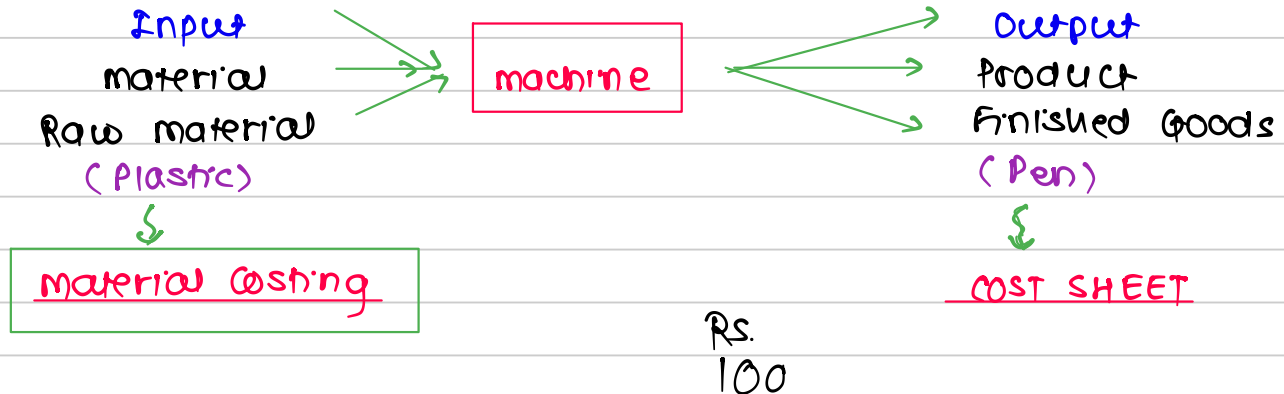
- Calculation of cost

related to

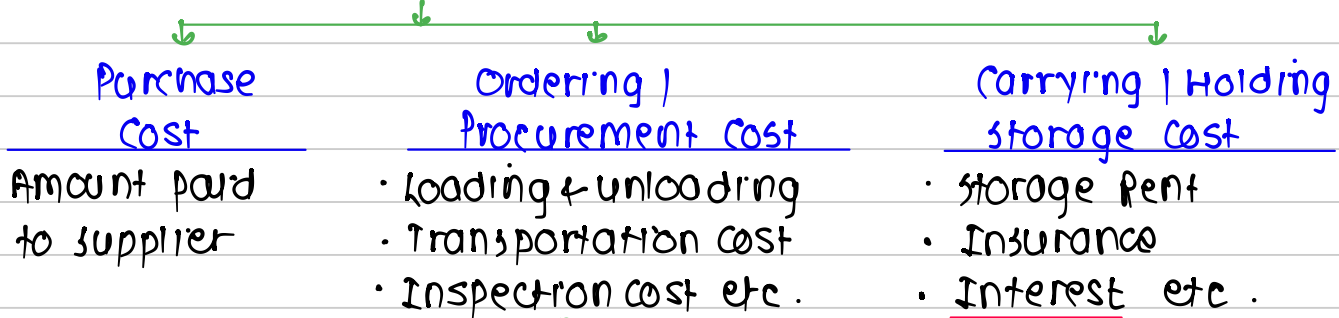
- Input required for production.

- Objective is to reduce material cost.

1. Input & Output:



2. Cost related to material:



- There is inverse relationship between ordering & carrying cost.

3. Economic Order Quantity: [EOQ]

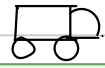
Q
Purchase manager

Question: How many units of RM should be purchased in a single order.

Answer: $EOQ = \sqrt{\frac{2AO}{C}}$

Purchase manager

Supplier



STORE

Factory

Purchase cost + ordering cost + carrying cost

Input → Output material

Total ↓

4.

4. Example for derivation of EOQ Formula:

- A : Annual Purchase of RM : 6000 kgs
 O : Ordering cost per order : 1000 per order
 PC : Purchase Cost per unit of RM : 30 per unit
 % : : 10% p.a.
 C : Carrying Cost per unit p.a. : $30 \times 10\% = 3$ per unit p.a.

options:

Q: Quantity to be purchased in a single order) 1000 kgs
 or b) 2000 kgs
 or c) 3000 kgs

Select the best option.

Solution:Statement showing Total Annual Cost:

Particulars	Quantity (Q)		
	1000	2000	3000
A) Annual Purchase Cost: (A x PC)	180,000 (6000 x 30)	180,000 (6000 x 30)	180,000 (6000 x 30)
B) Annual Ordering Cost: $\left(\frac{A}{Q} \times O\right)$ No of orders	6000 $\left(\frac{6000}{1000} \times 1000\right)$	3000 $\left(\frac{6000}{2000} \times 1000\right)$	2000 $\left(\frac{6000}{3000} \times 1000\right)$
C) Annual carrying cost: $\left(\frac{Q}{2} \times C\right)$	1500 $\left(\frac{1000 \times 3}{2}\right)$	3000 $\left(\frac{2000 \times 3}{2}\right)$	4500 $\left(\frac{3000 \times 3}{2}\right)$
Total cost	187500	186000	186500

Recommendation:

Company should place order for 2000 units as total cost is lowest.

DERIVATION OF EOQ FORMULA:

Total cost is minimum when,

$$\frac{\text{Annual ordering cost}}{\text{}} = \frac{\text{Annual carrying cost}}{\text{}}$$

$$\frac{A}{Q} \times O = \frac{Q}{2} \times C$$

$$\frac{2AO}{Q} = QC$$

$$2AO = Q^2 C$$

$$\frac{2AO}{C} = Q^2$$

$$\sqrt{\frac{2AO}{C}} = Q$$

$$\text{EOQ} = \sqrt{\frac{2AO}{C}}$$

$$= \sqrt{\frac{2 \times 6000 \times 1000}{3}}$$

$$= 2000$$



CW. 1

(WNT-1)

Details:

A : 10,000

O : 50

PC : 2 per unit

% : 8% p.a.

C : $2 \times 8\% = 0.16$

$$1. \quad \text{EOQ} = \sqrt{\frac{2AO}{C}} = \sqrt{\frac{2 \times 10,000 \times 50}{0.16}} = 2500 \text{ Kgs.}$$

$$2. \quad \text{No of orders} = \frac{A}{Q} = \frac{10,000}{2500} = 4 \text{ orders.}$$



CW. 2

(WNT-1)

Details:Correct Purchase Cost

A : 5000

O : 16

PC : 20

% : 20% (2+12+6)

C : $20 \times 20\% = 4$ Incorrect Purchase Cost

A : 5000

O : 16

PC : 12.8

% : 20% (2+12+6)

C : $12.8 \times 20\% = 2.56$ 1. EOQ:

$$\sqrt{\frac{2 \times 5000 \times 16}{4}} = 200 \text{ units}$$

$$\sqrt{\frac{2 \times 5000 \times 16}{2.56}} = 250 \text{ units}$$

1. Statement showing Total Cost:

Particulars	200 units	250 units
A) Annual Purchase Cost (A x PC)	100,000 (5000 x 20)	64,000 (5000 x 12.8)
B) Annual Ordering Cost [No of Orders (A/Q) x O] x O	400 [(5000 ÷ 200) x 16] 25 x 16	320 [(5000 ÷ 250) x 16] 20 x 16
C) Annual carrying cost ($\frac{Q}{2} \times C$)	400 ($\frac{200}{2} \times 4$)	320 ($\frac{250}{2} \times 2.56$)
Total Cost	100,800	64,640



CW. 3

(WNT) Details:

A : 4000 x 12 months = 48000 →

O : 120

PC : 20

% : 10%

C : 20 x 10% = 2

A = Annual RM

RM : FC

(Component x) (Product)

$$\frac{1}{?} \div \frac{1}{48000 (4000 \times 12)}$$

$$1. \quad EOQ = \sqrt{\frac{2 \times 48000 \times 120}{2}} = 2400 \text{ units}$$

2. Statement showing Total Annual Cost

Particulars	EOQ 2400 units	minimum 4000 units
a) APC (A x PC)	96,000 (48000 x 20)	96,000 (48000 x 20)
b) AOC [(A ÷ Q) x O] No of orders x O	2400 [(48000 ÷ 2400) x 120] 20 x 120	1440 [(48000 ÷ 4000) x 120] 12 x 120
c) ACC ($\frac{Q}{2} \times C$)	2400 ($\frac{2400}{2} \times 2$)	4000 ($\frac{4000}{2} \times 2$)
Total Cost	96,480	96,540

Extra Cost to be incurred = Rs. 640

3. Minimum carrying cost:

Out of two available options, minimum carrying cost is at EOQ i.e. Rs. 2400.



CW. 5

(WN-1) Details:

A : 40,000

O : 750 (360+390)

Pc : 60

% : -

C : Carrying per unit p.a.

$$0.5 \times 12 = 6$$

9

15

$$\left(\begin{array}{cc} \text{RM:} & \text{Fg} \\ \text{(kgs)} & \text{(units)} \\ 1 & \times 2.5 \\ ? & 100,000 \end{array} \right)$$

$$1. \text{ EOQ} = \sqrt{\frac{2 \times 40,000 \times 750}{15}} = 2000 \text{ kgs.}$$

2. Frequency of orders:

$$a) \text{ No of orders} = \frac{A}{Q} = \frac{40,000}{2,000} = 20 \text{ orders.}$$

b) frequency:

$$\begin{array}{cc} \text{orders} & \text{days} \\ 20 & 365 \\ 1 & ? \end{array} \quad \begin{array}{c} 18.25 \\ \text{Approx 18 days} \end{array}$$



CW. 4

Reference Notes:

• ZED company is trader so it will purchase Fg (not RM)

∴ A = Annual Fg ~~RM~~

• Lead time means delivery time:

(WN-1): Details:

A : 40,000 packs

O : 8

PC : 40

I : 10%.

C : $40 \times 10\% = 4$

$$1. \text{EOQ} = \sqrt{\frac{2 \times 40,000 \times 8}{4}} = 400 \text{ packs.}$$

$$2. \text{No of orders} = \frac{40,000}{400} = 100 \text{ orders}$$

3. Total Cost:

Annual ordering cost (100 × 8)	800
Annual carrying cost $[(400 \div 2) \times 4]$	800
	1600

4. Placement of next order:

a) No of days for which present inventory can be used 3 days

$$\left(\begin{array}{cc} \text{Packs} & \text{Days} \\ 40,000 & 360 \\ 333 & ? \end{array} \right)$$

b) Lead time (Delivery time) (3 days)

company should place order immediately

2. Various Stock Levels

Concept Question

<u>Particulars</u>	<u>consumption</u> (usage)	<u>Lead time</u> (Re-order period)
minimum	10 Kgs	2 days
Normal (Average)	20 Kgs $\left(\frac{10+30}{2}\right)$	3 days $\left(\frac{2+4}{2}\right)$
maximum	30 Kgs	4 days

Re-order Quantity = 1000 Kgs
 safety stock = 60 Kgs.
 Calculate Various stock levels.

Solution

$$\begin{aligned}
 1. \text{ Re-order Level (ROL)} &= \text{maximum consumption} \times \text{maximum Lead time} \\
 &= 30 \times 4 \\
 &= 120
 \end{aligned}$$

"OR"

$$\begin{aligned}
 \text{ROL} &= \text{safety stock} + \left(\text{Average consumption} \times \text{Average Lead time} \right) \\
 &= 60 + (20 \times 3) \\
 &= 60 + 60 \\
 &= 120
 \end{aligned}$$

$$\begin{aligned}
 2. \text{ minimum stock level (safety stock)} &= \text{Re-order Level} - \left(\text{Average consumption} \times \text{Average Lead time} \right) \\
 &= 120 - (20 \times 3) \\
 &= 60
 \end{aligned}$$

$$\begin{aligned}
 3. \text{ maximum stock level} &= \text{Reorder Level} + \text{Reorder Quantity} - \left(\text{minimum consumption} \times \text{minimum lead time} \right) \\
 &= 120 + 1000 - (10 \times 2) \\
 &= 1120 - 20 \\
 &= 1100
 \end{aligned}$$

4. Average stock level:

a)
$$\frac{\text{minimum stock} + \text{maximum stock}}{2}$$

$$= \frac{60 + 1100}{2}$$

$$= 580$$

b)
$$\text{minimum stock level} + \left(\frac{ROQ}{2} \right)$$

$$= 60 + \left(\frac{1000}{2} \right)$$

$$= 60 + 500$$

$$= 560$$



CW. 8

(Q. No.)	<u>Details:-</u>	<u>A</u>		<u>B</u>	
	<u>Particulars</u>	<u>consumption</u>	<u>Lead time</u>	<u>consumption</u>	<u>Lead time</u>
	minimum	25	4	25	2
	Average	50	5 $\left(\frac{4+6}{2}\right)$	50	3 $\left(\frac{2+4}{2}\right)$
	maximum	75	6	75	4
		ROQ = 300		ROQ = 500	

	<u>Particulars</u>	<u>A</u>	<u>B</u>
1.	Re-order Level	75×6 450	75×4 300
2.	minimum stock level =	$450 - (50 \times 5)$ 200	$300 - (50 \times 3)$ 150
3.	maximum stock level =	$450 + 300 - (25 \times 4)$ 650	$300 + 500 - (25 \times 2)$ 750
4.	Average stock level =	$\frac{200 + 650}{2}$ = 425	$\frac{150 + 750}{2}$ 450



CW. 9

(WN-1)

Details

A : 5000

O : 20

C : 5

(WN-2)

ROQ

If question is silent then EOQ = ROQ

$$\sqrt{\frac{2AO}{C}} = \sqrt{\frac{2 \times 5000 \times 20}{5}} = 200 \text{ units}$$

(WN-3)

Details

<u>Particulars</u>	<u>consumption</u>	<u>lead time</u>
minimum	* 10	5 days
Average	15	10 days
maximum	20	15 days

ROQ = 200 units

Emergency lead time = 4 days

$$* \text{ Avg consumption} = \frac{\text{min} + \text{max}}{2}$$

$$15 = \frac{\text{min} + 20}{2}$$

$$(15 \times 2) - 20 = \text{min}$$

$$\text{min} = 10$$

$$\begin{aligned} 1. \text{ Re-order} &= 20 \times 15 \\ \text{Level} &= 300 \text{ units} \end{aligned}$$

$$\begin{aligned} 2. \text{ maximum} &= 300 + 200 - (10 \times 5) \\ \text{stock level} &= 450 \text{ units} \end{aligned}$$

$$\begin{aligned} 3. \text{ minimum} &= 300 - (15 \times 10) \\ \text{stock level} &= 150 \text{ units} \end{aligned}$$

$$\begin{aligned}
 4. \text{ Danger Level} &= \text{Average Consumption} \times \text{Emergency Lead time} \\
 &= 15 \times 4 \\
 &= 60 \text{ units}
 \end{aligned}$$

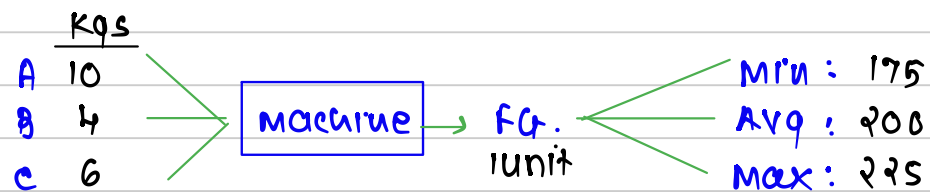
IF Average consumption is not given then take minimum consumption.

If stock reaches danger level then company has to place order on immediate basis. (i.e. emergency purchase)



CW. 10

Working:



Consumption (RM) depends upon production (FG)

1. Minimum stock of A:

$$\begin{aligned}
 \text{Re-order Level} &= \left(\text{Avg Consumption} \times \text{Avg Lead time} \right) \\
 &= 8000 - [(200 \times 10) \times 2] \\
 &= 8000 - 4000 \\
 &= 4000 \text{ kgs}
 \end{aligned}$$

2. Maximum stock of B

$$\begin{aligned}
 \text{Re-order Level} + \text{Re-order Qty} &= \left(\text{Minimum Consumption} \times \text{Minimum Lead time} \right) \\
 4750 + 5000 &= [(175 \times 4) \times 3] \\
 &= 7650 \text{ kgs}
 \end{aligned}$$

3. Re-order level of C:

$$\begin{aligned} & \text{maximum consumption} \times \text{maximum lead time} \\ & (225 \times 6) \times 4 \\ & 5400 \text{ kgs} \end{aligned}$$

4. Avg stock level of A:

$$\begin{aligned} & \text{minimum stock level} + \frac{\text{ROQ}}{2} \\ & 4000 + \left(\frac{10,000}{2} \right) \\ & 9000 \text{ kgs} \end{aligned}$$

If another formula used
then 10125 kgs



CW. 11

(WNT) Details:

A : 54000
O : 9000
C : 300

Average consumption = 150 (54000 ÷ 360)
Average Lead time = 6 days

1. $EOQ = \sqrt{\frac{2 \times 54000 \times 9000}{300}} = 1800 \text{ castings}$

2. 15% Risk of being out of stock:

a) Re-order level = 7 days × 150 = 1050 castings

b) Safety stock = $ROL - (\text{Avg consumption} \times \text{Avg Lead time})$
 $= 1050 - (6 \times 150)$
 $= 150 \text{ castings}$

3. 5% Risk of being out of stock:

a) Re-order level = 9 days × 150 = 1350 castings

b) Safety stock = $ROL - (\text{Avg consumption} \times \text{Avg Lead time})$
 $= 1350 - (6 \times 150)$
 $= 450 \text{ castings}$

4. Total Annual Cost (5% Risk)

a) Annual ordering cost

$$\left(\frac{A}{Q} \times O \right)$$

$$\frac{270,000}{\left(\frac{54000}{1800} \times 9000 \right)}$$

b) Annual carrying cost ✓

$$\left(\text{safety stock} + \frac{Q}{2} \right) \times C$$

$$\frac{405000}{\left[\left(450 + \frac{1800}{2} \right) \times 300 \right]}$$

675000

5. New EOQ & Frequencya) New EOQ:

$$\sqrt{\frac{2 \times 54000 \times 600}{720}} = 300 \text{ cashings}$$

b) Frequency:old policy (EOQ = 1800)

$$\begin{array}{cc} \text{orders} & \text{days} \\ (54000/1800) & 30 \times 360 \\ 1 & (?) \\ & \underline{120 \text{ days}} \end{array}$$

New Policy (EOQ = 300)

$$\begin{array}{cc} \text{orders} & \text{days} \\ (54000/300) & 180 \times 360 \\ 1 & ? \\ & \underline{2 \text{ days}} \end{array}$$



CW. 20

Particulars

A

B

1. Inventory Turnover Ratio (Times)

$\frac{\text{RMC}}{\text{Avg Stock}}$	=	$\frac{10,000 + 52,000 - 6,000}{(10,000 + 6,000) \div 2}$	$\frac{9,000 + 27,000 - 11,000}{(9,000 + 11,000) \div 2}$
	=	$\frac{56,000}{8,000}$	$\frac{25,000}{10,000}$
	=	7 times	2.5 times

2. Inventory Turnover Ratio (Days)

$\frac{365}{\text{Ratio in Times}}$	$\frac{365}{7}$	$\frac{365}{2.5}$
	52 days	146 days

comment: Material A is moving faster than material B.



HW. 8

1. $\frac{250,000}{100,000} = 2.5 \text{ times}$

2. $\frac{365}{2.5} = 146 \text{ days}$

4. RATE PER UNIT

q) **Formula:** $\frac{\text{Total Cost related to material} - \text{Scrap Value}}{\text{Total Quantity} - \text{Normal loss Quantity}}$



CW. 14

(WN-1) Net Quantity:

Particulars	A	B
Total kgs	10,000	8000
(→ Normal loss)	(500)	(320)
	9500	7680
(→ Provision @ 2%)	(190)	(153.6)
	9310	7526.4

1. Rate per kg

Particulars	A	B
Purchase cost	100,000	104,000
Custom Duty @ 10%	10,000	10,400
	(100,000 × 10%)	(104,000 × 10%)
Freight	2,133	1,707
Total = A + B		
(kg) 18,000 = 10,000 + 8,000		
(₹) 3,840 × ? × ?		
Total cost	112,133	116,107
÷ Net Quantity	÷ 9,310	÷ 7,526.4
	12.04	15.43



HW. 6

1. Rate per unit

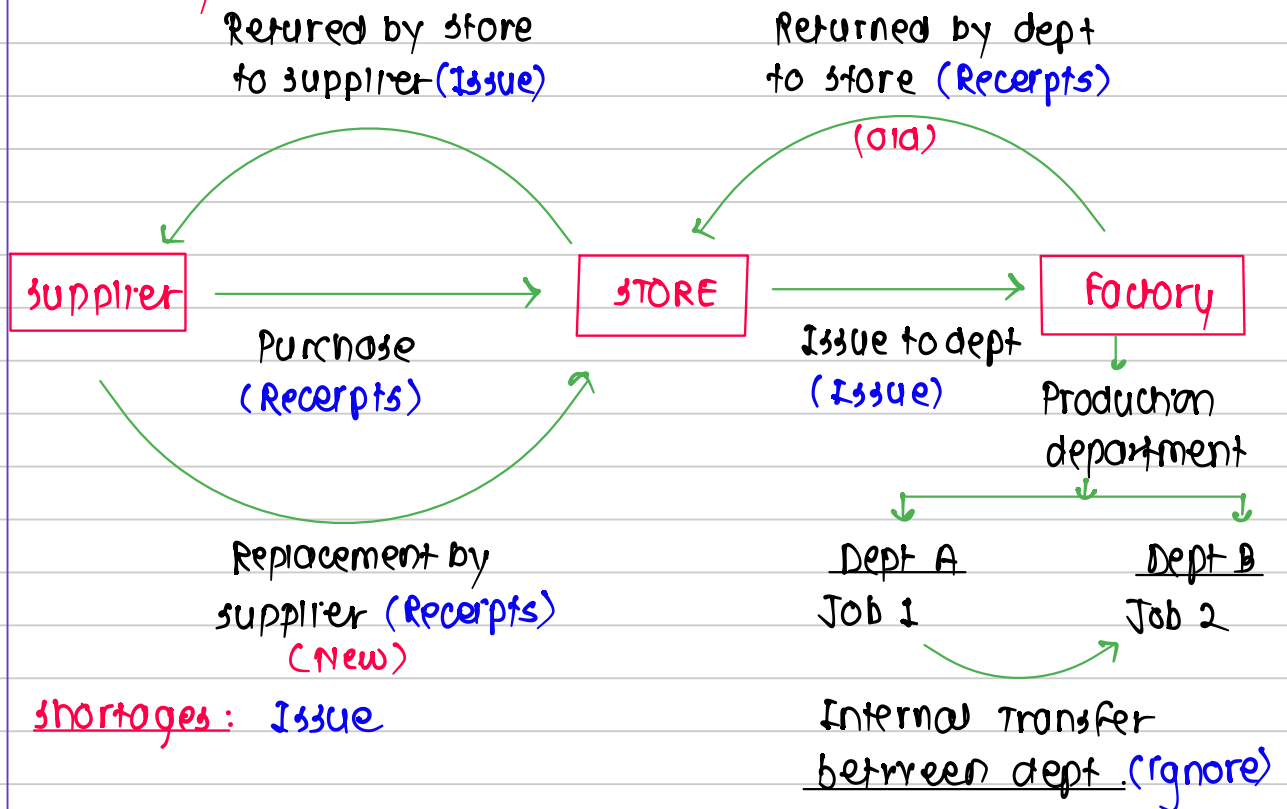
Purchase cost	800
+ Packing cost	50
Total cost	850
÷ Net units	÷ 200
	4.25

Notes:

a) I.G.T is ignored as credit is available

b) Cash discount is ignored as it is connected to finance.

5. STORE LEDGER

* Summary



CW. 17

1. STORE LEDGER:

FIFO

<u>Date</u>	<u>Receipt</u>			<u>Issues</u>			<u>Balance</u>		
	<u>Q</u>	<u>P</u>	<u>C</u>	<u>Q</u>	<u>P</u>	<u>C</u>	<u>Q</u>	<u>P</u>	<u>C</u>
<u>JAN</u>									
1	100	1	100				100	1	100
20	100	2	200				100	1	100
							100	2	200
22 (Job 16)				60	1	60	40	1	40
							100	2	200
23 (Job 17)				40	1	40	80	2	160
				20	2	40			
						80			

LIFO

<u>Date</u>	<u>Receipt</u>			<u>Issues</u>			<u>Balance</u>		
	<u>Q</u>	<u>P</u>	<u>C</u>	<u>Q</u>	<u>P</u>	<u>C</u>	<u>Q</u>	<u>P</u>	<u>C</u>
<u>JAN</u>									
1	100	1	100				100	1	100
20	100	2	200				100	1	100
							100	2	200
22 (Job 16)				60	2	120	100	1	100
							40	2	80
23 (Job 17)				40	2	80	80	1	80
				20	1	20			
						100			

WAM

<u>Date</u>	<u>Receipt</u>			<u>Issues</u>			<u>Balance</u>		
	<u>Q</u>	<u>P</u>	<u>C</u>	<u>Q</u>	<u>P</u>	<u>C</u>	<u>Q</u>	<u>P</u>	<u>C</u>
<u>Jan</u>									
1	100	1	100				100	1	100
20	100	2	200				100	1	100
							100	2	200
							200	(1.5)	300
							(300 ÷ 200)		
22 (Job 16)				60	1.5	90	140	1.5	210
							(210 ÷ 140)		
23 (Job 17)				60	1.5	90	80	1.5	120
							(120 ÷ 80)		

2. Table:

<u>Particulars</u>	<u>FIFO</u>	<u>LIFO</u>	<u>WAM</u>
Job 16	60	120	90
Job 17	80	100	90
closing stock	160	80	120

3. Discuss:

<u>Particulars</u>	<u>FIFO</u>	<u>LIFO</u>	<u>WAM</u>
Cost of material :	Minimum	Maximum	Avg
Profit :	Maximum	Minimum	Avg
Closing stock :	Maximum	Minimum	Average
			(It will avg out things)

∴ WAM will be preferred.

Refer Page 2.86

in ICAI module

CW. 18

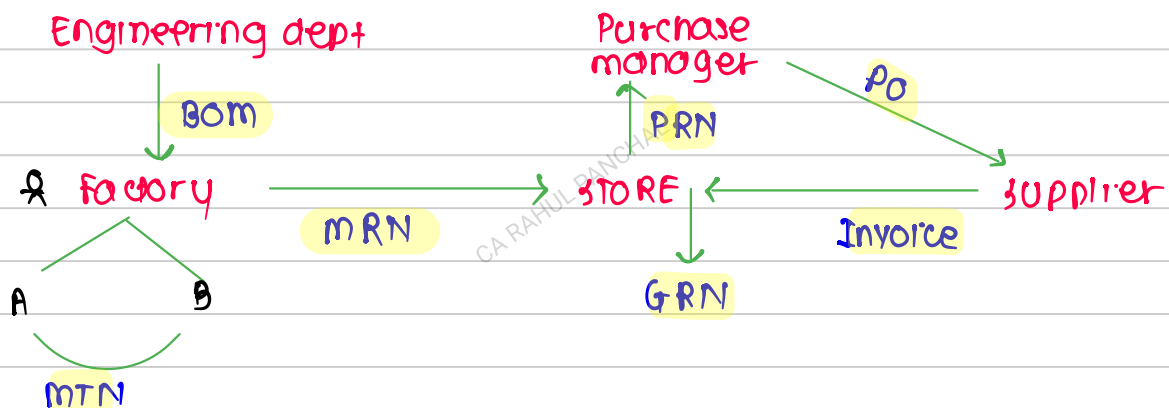
STORE LEDGER (FIFO)

Date	Receipts			Issues			Balance		
	Q	x	P = C	Q	x	P = C	Q	x	P = C
Sept 20x1									
1.							25	6.5	162.5
									(162.5 ÷ 25)
4				8	6.5	52	17	6.5	110.50
6	50	5.75	287.5				17	6.5	110.50
	(B & Co)						50	5.75	287.50
7				12	6.5	78	5	6.5	32.50
							50	5.75	287.50
10				10	5.75	57.5	5	6.5	32.50
				(Returned to B & Co)			40	5.75	230
12				5	6.5	32.50			
				10	5.75	57.50	30	5.75	172.50
13				20	5.75	115	10	5.75	57.50
15	25	6.10	152.50				10	5.75	57.50
	(M & Co)						25	6.10	152.50
17				10	5.75	57.50	25	6.10	152.50
19	10	5.75	57.50				25	6.10	152.50
							10	5.75	57.50
20	5	5.75	28.75				5	5.75	28.75
							25	6.10	152.50
							10	5.75	57.50

	Receipts	Issues	Balance
Date	Q x P = C	Q x P = C	Q x P = C
26		5 5.75 28.75	20 6.10 122
		5 6.10 30.5	10 5.75 57.50
30		2 6.10 12.2	18 6.10 109.8
			10 5.75 57.50
			<u>28 x 167.30</u>

Treatment of Shortage:

The material found short as a result of stock taking has been written off at relevant issue price.



6. Stock out VS Carrying cost

CW. 13

(QNT-7): Calculation of Probability:

stock out of tyres	No of times	Probability (%)
100	2	2%
80	5	5%
50	10	10%
20	20	20%
10	30	30%
0	33	? 33%
	100	100

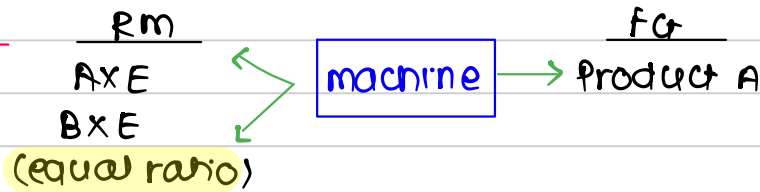
1. Statement showing Total Cost:

safety stock level	stock out (units)	stockout cost	Carrying cost	Total cost
100	-	-	100×50 5000	5000
80	20	$20 \times 150 \times 2\%$ 60	80×50 4000	4060
50	50	$50 \times 150 \times 2\%$ $30 \times 150 \times 5\%$ 375	50×50 2500	2875
20	80	$80 \times 150 \times 2\%$ $60 \times 150 \times 5\%$ $30 \times 150 \times 10\%$ 1140	20×50 1000	2140
10	90	$90 \times 150 \times 2\%$ $70 \times 150 \times 5\%$ $40 \times 150 \times 10\%$ $10 \times 150 \times 20\%$ 1695	10×50 500	2195

safety stock level	stock out (units)	stockout cost	carrying cost	Total cost
0	100	$100 \times 150 \times 2\%$		
	80	$80 \times 150 \times 5\%$		
	50	$50 \times 150 \times 10\%$		
	20	$20 \times 150 \times 20\%$		
	10	$10 \times 150 \times 30\%$		
		2700	-	2700

Decision: Optimum safety stock level = 20 units
(Because total cost is lowest in this case)

CW. 12

working:1. Input (Kgs)

(Product)

Input - loss = Output

$$(\%) \quad 125 - 25 = 100$$

$$! = 1 \text{ Kg.}$$

1.25 Kgs

A: 0.625 kgs

B: 0.625 kgs

} Equal ratio.

2. Cost & sales values:

material cost: AXE : (0.625 × 150)	93.75		%
BXE : (0.625 × 90)	56.25	150	100
Production Expenses (150 × 40%)		60	40
Total cost		210	140
+ Profit (210 × 20%)		42	
Sales		252	

Total sales value & Profit will remain same

∴ Total cost will remain same (i.e. 210)

∴ Total material cost should be Rs. 150.

3. Ratio of AXE & CXE:

Let's assume CXE = 2 Kgs

$$\therefore \text{AXE} = 1.25 - 2$$

Cost of AXE + Cost of CXE = Total material cost

$$[(1.25 - 2) \times 150] + [2 \times 75] = 150$$

$$187.5 - 150 \times 2 + 75 \times 2 = 150$$

$$187.5 - 150 = 150 \times 2 - 75 \times 2$$

$$37.5 = 75 \times 2$$

$$2 = 0.5$$

CXE = 0.5 Kgs

$$\text{AXE} = 1.25 - 0.5 = 0.75 \text{ Kgs}$$

Ratio

AXE : CXE

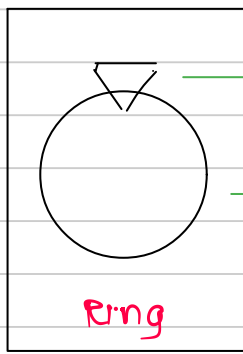
$$0.75 : 0.5$$

$$3 : 2$$

CW 15
✓ CW 16
✓ CW 19

CA RAHUL PANCHAL

7. ABC Analysis



	<u>% Quantity</u>	<u>% Amt</u>
Diamond : minimum 10%		maximum 70%
Gold : moderate 20%		moderate 20%
Box : maximum 70%		minimum 10%

CA RAHUL PANCHAL

A = Annual Purchase OF RM

<u>RM</u>	RM : FQ	
A : 36200	D : E	
O : 720	2 X : 1	
PC : 125	36400 RMC	18200
% : 13.76%		
C : 1702	opening + purchase - closing = RMC	
	200 - NZL = 36400	
	Purchase = 36200	

	<u>Consumption</u>	<u>lead time</u> (Days)
min		4
Avg		6
max	7206	8

CA RAHUL PANCHAL

mat casting

