	H : M
ROCA	: 56
TPM	1 : 45
LSEI	: 27
Fastrack	: 17
Launch	: 16
	1 : 161
	+2 (120)
	3 : 41 min

1 : 20 min

TPM

↓

Total **Productive** maintenance

↓

machine

Q2 = ✓
TYK4 = ✓
5 = ✓
6 = ✓

OEE

↓

Overall Equipment Effectiveness

World class OEE

Availability	Performance	Quality
> 90%	> 95%	> 99%

$0.90 \times 0.95 \times 0.99 = 0.8465$ → 84.65% ≅ 85%

Example:

Availability

Total Hours: 10 Hours
Planned downtime (2 Hours)
Planned Production 8 Hours (b)
Unplanned downtime (2 Hours)
Operated / Actual time 6 Hours (a)

$\frac{6}{8} \times 100$ → $a/b \times 100$

= 75%

Performance

	Std	Actual
Output	7 units	7 units
Time	7 Hours (a)	6 Hours (b)

$\frac{7}{6} \times 100$ → $a/b \times 100$

116.67%

Quality

Total 7 units (b)
Defective 2 units
Good 5 units (a)

$\frac{5}{7} \times 100$

71.43%

Q 2 Page 3.22

Availability (min)		Performance	Std	Actual	Quality	
Total Time (12×60)	720	Output	3360	3360	Total	3360
Planned downtime ①	(55)	Time	560	629	Defective	75
Planned Production	665	$\left(\frac{3360 \times 10}{60}\right)$			Good	3285
Unplanned downtime	(36)					
Operated / Actual time	629					

$\frac{629}{665} \times 100$

$= 94.59\%$

$\frac{560}{629} \times 100$

$= 89.03\%$

$\frac{3285}{3360} \times 100$

97.77%

① (15 min × 3 Breaks) + 10 min

Overall Equipment Effectiveness (OEE)

Availability × Performance × Quality

$0.9459 \times 0.8903 \times 0.9777$

0.8234

82.34%

Comment:

	Availability	× Performance	× Quality	= OEE
Ideal :	>90%	>95%	>99%	= 85%
Present :	94.59%	89.03%	97.77%	= 82.34%

- It is exceeding the ideal value of 90%.
- It is below ideal value
- Attention is required.
- very close to worldclass performance
- measure should be taken to improve & attaine 85%.

* 1 shift

TYK 4

Availability (min)		Performance			Quality	
Total Time (9x60)	540		Std	Actual	Total	140
Planned downtime ①	60	Output	140	140	Defective	
Planned Production	480	Time	420 min (140x3)	450 min	Good	131
Unplanned downtime ②	30					
Operated / Actual time	450					
$\frac{450}{480} \times 100 =$		$\frac{420}{450} \times 100$			$\frac{131}{140} \times 100$	
93.75%		93.33%			93.57%	

① 30min + 15min + 15min = 60 min

② Unplanned downtime :

Breakdown	6
Set up	14
Power failure	4
Total Hours (4 weeks)	24 Hours
	x 60
Total minutes (4 weeks)	1440 minutes
÷ No of shifts (2 shifts x 6 days x 4 weeks)	÷ 48 shifts
	30 minutes

→ 9mp.

Overall Equipment Effectiveness (OEE)

Availability x Performance x Quality

0.9375 x 0.9333 x 0.9357

0.8187

81.87 %

TYK 5

1 shift

Availability	Performance	Quality
Total Time (8x60) 480	Std Actual	Total 140
Planned downtime ① (35)	output 140 ③ 140	Defective (40+2) 20
Planned Production 445	Time 350 min 400 min	Good 120
Unplanned downtime ② (45)	(140 x 2.5)	
Operated / Actual time 400		
$\frac{400}{445} \times 100$	$\frac{350}{400} \times 100$	$\frac{120}{140} \times 100$
= 89.89%	87.50%	85.71%

① 25min + 10 min

② 1 day has 2 shifts ∴ 90min ÷ 2 shifts = 45 min

③ 280 ÷ 2 shifts = 140 units

Overall Equipment Effectiveness (OEE)

Availability x Performance x Quality

0.8989 x 0.8750 x 0.8571

0.6741

67.41 %

1 month.

TYK 6

Availability	Hrs.
Total Time:	-
Planned downtime	-
Planned Production	238
Unplanned downtime	(28)
Operated / Actual time	210

$\frac{210}{238} \times 100$

88.24%

Performance	Std	Actual
Output	2800	2800
Time (Hrs)	180	210

$\frac{180}{210} \times 100$

85.71%

Quality	
Total	2800
Defective	
Good	2520

$\frac{2520}{2800} \times 100$

90%

Overall Equipment Effectiveness (OEE)

Availability x Performance x Quality

0.8824 x 0.8571 x 0.90

0.6807

68.07%

Comments:

	Availability	× Performance	× Quality	= OEE
Ideal :	> 90%	> 95%	> 99%	= 85%
Present :	88.24%	85.71%	90%	= 68.07%

Company should collect information relating to downtime and losses on equipment & should take improvement decision like autonomous maintenance, preventive maintenance & reduction in set up time.

- World class OEE is not achieved
- Company got some opportunities for improvement

ROCA Rank order Clustering Algorithm.

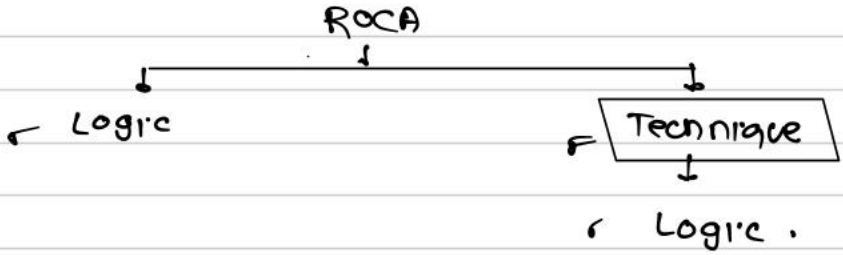
TYK @ 3.49.

Logic:

	P101	P107
m2		
m 12		
m 15		

	P104	P105	P108
m7			
m 13 A			

P101 P107	P104 P105 P108
M2 M13 M15	M7 M13A .



Technique: ROCA .

Step 1:
- Binary weights to Column (Right to Left)
- Assign weights to Row
- Assign Ranks to Row

Step 2:
- Re-arrange Rows as per Ranks
- Binary weights to ~~Column~~ Row
- Assign weights to ~~Row~~ Column
- Assign Ranks to ~~Row~~ Column.

Step 3:
- Re-arrange Columns as per Ranks
- Binary weights to Column
- Assign weights to Row
- Assign Ranks to Row

If Ranking is 1, 2, 3, 4, 5 (i.e. in sequence) then STOP.

ROCA

↓

Rank Order Clustering Algorithm

TYK 8

Basic :

	P101 ✓	P107 ✓
M2	1	
M13	1	1
M15		1

	P104 ✓	P108	P105
M7	1	1	
M13A	1		1

Solution of ICA1

Step 1:
- Binary weights to column (Right to left)
- Assign weights to Row.
- Assign Ranks to Row (Rank 1 to highest value)

Step 2:
- Re-arrange rows as per Ranks
- Binary weights to Rows (down to up)
- Assign weights to Columns
- Assign Ranks to Columns (Rank 1 to highest value)

Ranks are in sequence (like 1,2,3,4,5)
↓
"STOP"

Ranks are not in sequence (like 1,3,4,2,5)
↓
"Re-peat step 1

iii)

a)

	P101	P104	P105	P107	P108	② weight	③
m 2	1					16	2
m 7		1			1	9	4
m 13	1			1		18	1
m 13A		1	1			12	3
m 15				1		2	5
weights.	16	8	4	2	1		

①

b)

	P101	P104	P105	P107	P108	① weight	
m 13	1			1		16	
m 2	1					8	
m 13A		1	1			4	
m 7		1			1	2	
m 15				1		1	
②weights.	24	6	4	17	2		
③ Rank	1	3	4	2	5		

c)

	P101	P107	P104	P105	P108	weight	Ranks
m 13	1	1				24	1
m 2	1					16	2
m 13A			1	1		6	4
m 7			1		1	5	5
m 15		1				8	3
weights.	16	8	4	2	1		

d)

	P101	P107	P104	P105	P108	weight	
m 13	1	1				16	
m 2	1					8	
m 15		1				4	
m 13A			1	1		2	
m 7			1		1	1	
weights.	24	20	3	2	1		
Rank	1	2	3	4	5		

Since the ranking is now nearly arranged in order, stop the process.

Working cell / cluster:

Cluster	Part	machines
1	P101 & P107	m13, m2 & m15
2	P104, P105 & P108	m13 A & m7

1 ✓
2 ✓
3 ✓
4 ✓
5 ✓
6 ✓
7 ✓
8 ✓
9 ✓
10 ✓
11 ✓
12 ✓