

# Written Examination

## Industrial Engineering MTT050

Date: 2009-04-14

Time: pm

Place: V

Aids: Chalmers approved calculator (*typgodkänd miniräknare*)

Max points: 50p

Grades: Grade 3: 20p; Grade 4: 30p; Grade 5: 40p.

Examiner: Peter Almström tel. 772 12 83, 076 1010567

Final results will be published before 2009-05-05.

Times for checking results are 2009-05-05 at 12.00-13.00 and 2009-05-07 at 12.00-13.00.

Place: Materials and Manufacturing Technology, Rännvägen, House M6

*General instructions: It is your responsibility to formulate your answers in such a way that it is clear for the teacher that you have understood the course content. Express yourself clearly and motivate your answers. Write with a readable handwriting. Use a new sheet for every new question (not for every sub-question). Good luck!*

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1. F.W. Taylor summarize Scientific Management in the following five points:

1. Science, not a rule of thumb.
2. Harmony, not discord.
3. Cooperation, not individualism.
4. Maximum output, in place of restricted output.
5. The development of each man to his greatest efficiency and prosperity.

How did Taylor put these five principles into practice in the Bethlem Steel case (Clue: Schmidt carrying pig iron)?

(5p)

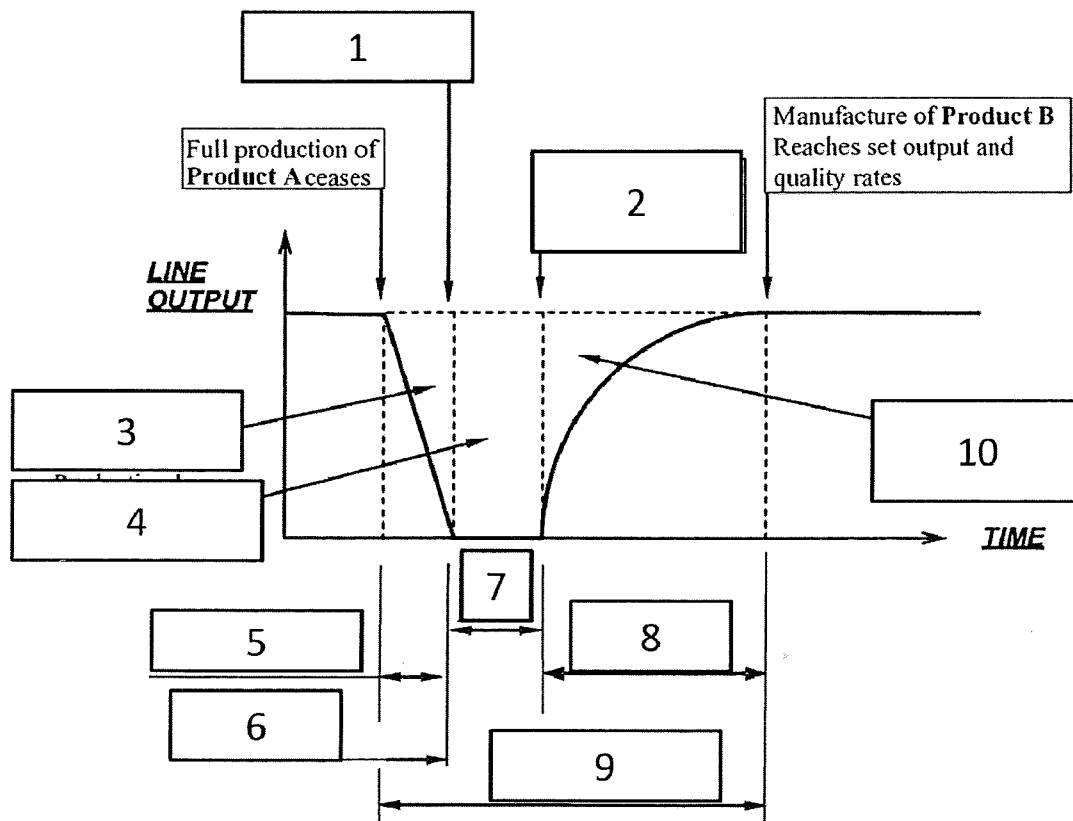
2. Calculate the standard time in seconds for the following operation using SAM. Detail the calculation by stating the codes and their corresponding Factor value in a table or by a simplified SAM form (the SAM form head is given below). You have to make reasonable assumptions about for example precision and force:

1. Get hydraulic block from pallet on floor and place on fixture on bench. Distance 1,20m.
2. Get two M5 screws and enter them in threaded holes on the block. Distance 0,40m.
3. Screw the screws by hand (10 strokes each) (code SA7 = 2 Factors).
4. Get manual ratchet wrench (*sv. spärrnyckel*) and tighten the screws (4 strokes each, high force for the last stroke) (code SF7 = 4 Factors). Return wrench. Distance 0,3m.

(5p)

GET						PUT						USE			RETURN PUT						Summing up Factors						
GS						PD									PD												
S	80	45	10	H	AW	S	80	45	10	P	AF	f	n	t	=	AF	AW	S	80	45	10	P	AF	B	F	f	Total
Step				Add. for Handful	Weight > 5 kg	Step				Add. for Precision	Apply Force	No. of strokes, grips etc..	No. of places	Time of stroke, grip etc		Apply Force	Weight > 5 kg	Step				Add. for Precision	Apply Force	Bend+Arise			
3	5	4	2	6	2	3	5	4	2	3	3					3	2	3	5	4	2	3	3	12			
3	5	4	2	6	2	3	5	4	2	3	3					3	2	3	5	4	2	3	3	12			

3. The following figure represents a set-up of a machine. What do the blank squares 1-10 represent?



(5p)

4. Three sub questions regarding DFA:

a) The three common reasons for keeping a part as a separate component are; that it moves in relation to other components, that it must be of other material, and to facilitate service or disassembly. Give two examples of other good reasons for keeping a part as a separate component. (1p)

b) Explain the function of a vibratory bowl feeder. (1p)

c) Explain the Bothroyd-Dewhurst quantitative DFA method step by step. (3p)

5. The number of required observations in a work sampling study is given by the following formula:

$$N = \frac{1,96^2 p(1-p)}{e^2}$$

$N$ =Number of observations  
 $p$ =Probability of a single occurrence  
 $e$ =Acceptable limit of error

Explain why  $N$  grows when there are more activities that need to be analysed ( $p$  will get smaller with more activities). (5p)

6. Five questions regarding indirect and expense labour:

a) What is the difference between indirect labour and expense labour? (1p)

b) What is the difference between value and productivity? (1p)

c) Why is it in most cases better to use value instead of productivity when improving indirect or expense labour? (1p)

d) Give two recommended methods for establishing a time standard for routine maintenance work of 0,5 to 3 hours length. (1p)

e) Explain the application of slotting for indirect or expense labour. (1p)

7. Two questions about performance rating:

a) Describe two different performance rating methods. (2p)

b) Why is performance rating necessary? Give three examples of different situations when it is necessary. (3p)

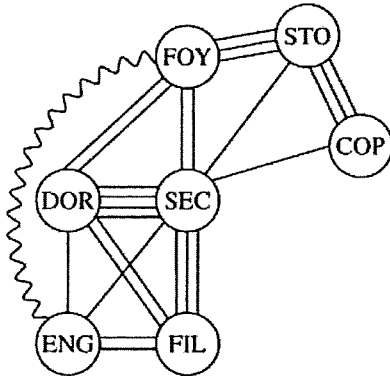
8. Two questions about PPA:

a) Who are the three stakeholders to PPA? (3p)

b) How is utilization of machine operators related to OEE? (2p)

9. Two questions regarding layout and balancing:

a) What kind of graph is this and what do the lines represent? (2p)



b) Define these terms:

- Throughput time
- Lead time
- Cycle time

10. People at different level in the company resist changes in manufacturing system. There is resistance at factory management level, among first line managers and among operators on the shop-floor. Explain the three categories' fears and why they may resist changes. Explain briefly how to overcome the resistance for the three categories of people. (5p)

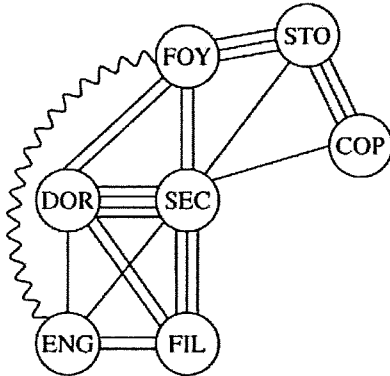
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