

TTE-5056 Assembly Technologies and Systems

Exam 22.5.2013

- Use of extra material and calculator is forbidden. **Use of English dictionary is allowed.**
- Answer in short but complete essays **in English**
- Maximum points is 24 and you need 12 to pass the exam

1. Modularization and DFA

- a. How product modularization can ease the assembly process when serving different customers? How MI-matrix can be used to help identifying the possible modules? (3p)
- b. Explain the term "DFA"? List at least ten (10) practical examples how to improve assemblability of a product from the automation point of view (you can use figures to help explaining your ideas). (3p)

2. Assembly strategies

- a. There are different types of assembly systems, i.e. manual systems, semi-automatic systems, dedicated/fixed automation and flexible automation. Explain the factors that affect to the selection of the system type (i.e. for what kind situations each of these systems are good?). (4p)
- b. What different strategies can be selected to cope with volume flexibility (varying demand) on assembly systems? (2p)

3. Equipment

- a. Grippers: What things you should consider when selecting a gripper for your application? Name and shortly describe five, in your opinion, most important things. (4p)
- b. What joining methods are applicable for joining two plastic parts? Shortly discuss the properties of the applicable joining methods and the requirements they put to part design and/or material selections. (2p)

4. Case problem

On the following page you see an exploded view of Nokia 101 mobile phone (image from <http://www.phoneworkshop.com/exploded-view/nokia-101-exploded-view-expanded-parts-layout>). Image is missing some information:

- ATO Swap package has small "clips" on the edges that fasten it to Light Swap package. These are one type of snap fits: once parts are aligned, you just need to push ATO Swap package downwards and it locks into place.
- 6 screws fix ATO Swap package and Light Swap package to D-cover assembly. Screws are located near the corners and in the middle of the long edges.

Otherwise the image shows all important information.

- a. Based on the exploded view, make the assembly stage decomposition model (ASDM) for the Nokia 101 mobile phone. On the last page you find an example of ASDM for another mobile phone – it is different phone with different components so do not copy it directly! (2 p)
- b. Based on the exploded view and the ASDM you made, sketch an assembly (manual/semi-automatic/automatic) line for this product (without any changes)

assuming that new product needs to be finished every 25 seconds. Shortly discuss and justify at least the following points: (4p)

- How many cells?
- What operations are done in each cell?
- How the product is transferred between cells?
- What kind of equipment you would use in each cell?

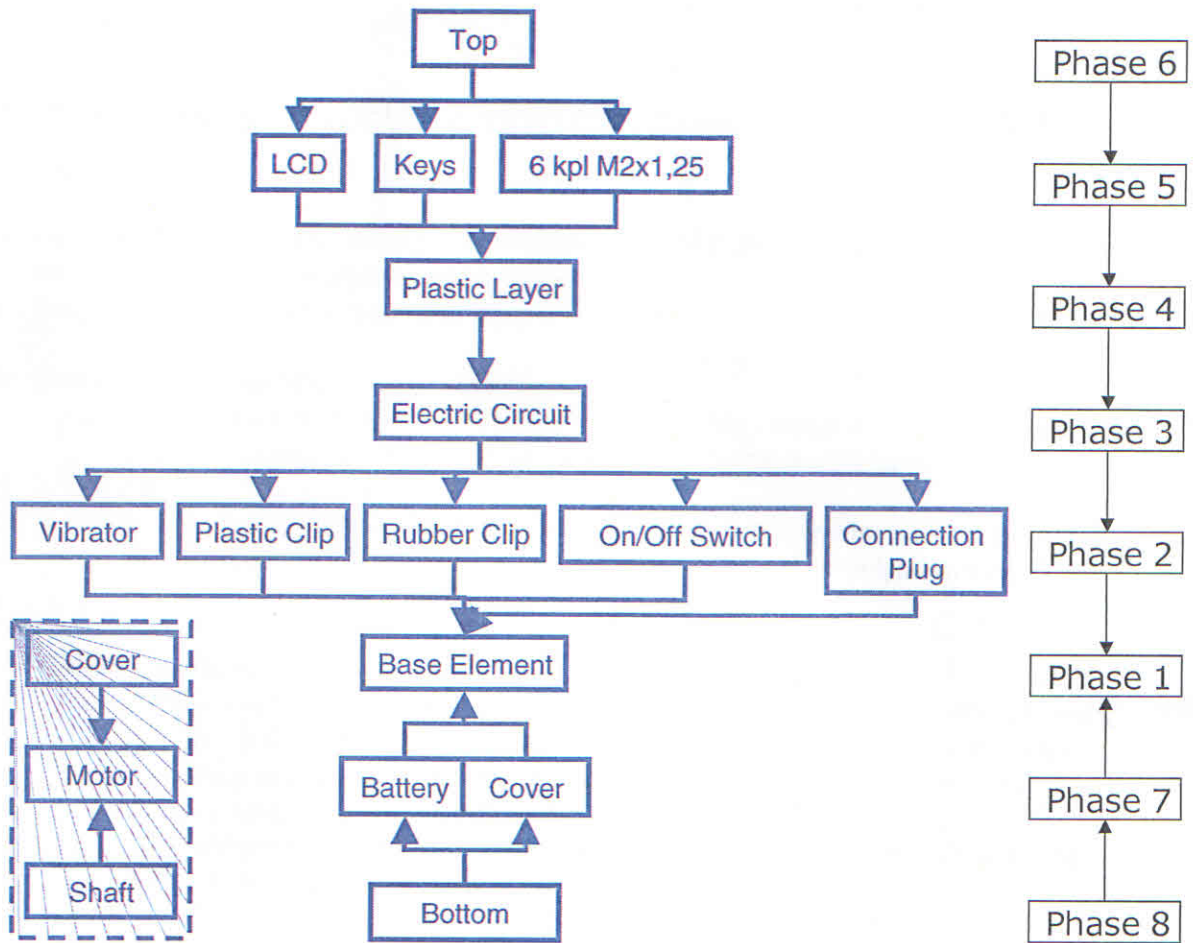
The diagram illustrates the assembly process for a mobile phone, divided into five stations:

- Station 1:** Shows the initial components: SD DOOR (I0002), A-COVER (I0001), and KEYMAT (I0003).
- Station A1 (ATO SWAP PACKAGE I0004, A2, I0008, A3):** Shows the LIGHT GUIDE (I0004) being installed.
- Station A2 (LIGHT SWAP PACKAGE I0005 - I0007):** Shows the LIGHT SWAP PWB (I0006) and DOMESHEET (I0005) being installed.
- Station A3 (D-COVER ASSEMBLY I0009 - I0010) (L3):** Shows the D-COVER (I0010), DC JACK (I0009), and TYPE LABEL (I0007) being installed. This station includes icons for 'Only available as assembly', 'Not reusable after removal', and 'Repair/swap only in level 3'.
- Station A4:** Shows the BATTERY COVER (I0011) being installed.

PHONE WORKSHOP

Ver. 1.0

* Only available as assembly
🗑️ Not reusable after removal
L3 Repair/swap only in level 3



Subassembly of the vibrator