

Lecture Plan for Product Design Induction

Duration: 50 mins

Date: 15/2/2022

Number of students: unknown but could be anywhere between 5 and 40.

General equipment: whiteboard with markers and eraser (deliverer)

Preparation: The students will be split into teams (size TBA depending on attendance). Display web page on a screen that the class can see.

1. Objectives
 - 1.1 Introduce the 'real' trials and tribulations of product development by running through some real examples of the challenges and rectification of the same.
 - 1.2 Test student's ability to problem solve in teams.
 - 1.3 Groom students to work at JJT

2. Plan

Task	Action	Equipment	Time (mins)
Introduction: my credentials;	Verbal.	(cards for students to take)	2
Deliver project brief	Deliver project brief (below) and verbal (set up teams/companies).	Project brief displayed via web	10
Evaluation Phase	All teams solve as many problems as possible. Leave them to absorb but give clues as deemed necessary	Displayed via web	20
My overview of each of the issues	I present what happened in each case.	verbal	10
Close and deliver business cards with a promise to respond. This is re-cap of introduction	Little speech about how rewarding the work is, and I want them working for me.	Business cards	3
Total			45

Brief

Read each of the scenarios below and suggest how the issues may be overcome

1. ESD failures

A PCBA used for the control of flow valves that deliver cold drinks is failing in early life, i.e., the PCBAs work when delivered from the factory but approximately 20% of them start failing in use. These dispensers are predominantly used in air-conditioned office areas. The PCBAs are installed by fitters who have no knowledge of electronics – they simply fit them in the enclosures provided.

Attempt to speculate what might be the problem and check that it is right with the person giving this lecture. If struggling, don't hesitate to ask for clues.

Suggest how this problem may be overcome bearing in mind that the customer will not pay for extra installation equipment and attempts to train the fitters have not been successful. You should look for a way to change the design such that the problem is unlikely to occur.

2. Voltage regulator failures

A PCBA that controls lighting being used in Florida is experiencing intermittent failure – from which there is recovery after the device has had a chance to cool down. The device control units, which contain the troublesome PCBAs, are in a loft with poor ventilation. The device has a microcontroller, and the symptoms are that the microcontroller periodically resets, which cause the lighting to switch on and off. The customer is annoyed. After investigation it has been discovered that the LDO voltage regulator the device uses is the cause of failure. It is supplied by 24V and provides 3V to the circuit.

Attempt to speculate what might be the problem and check that it is right with the person giving this lecture. If struggling, don't hesitate to ask for clues.

Suggest how the problem might be overcome with a redesign of the offending bit of the circuit.

3. Unexpectedly low output from a design with a UVC LED

Disinfection of surfaces using ultraviolet electromagnetic waves has become very topical, particularly with the struggles there have been with Covid. UVC kill bacteria very effectively. A design that uses a UVC LED to do this has just been prototyped, but it doesn't kill the bacteria. Measurement has shown that the output from the UVC is lower than had been calculated. The basis of the design was an LED specified as having 100mW (optical – not electrical) output. The designer had assumed that LED therefore was a point source of 100mW intensity.

Attempt to speculate what might be the problem and check that it is right with the person giving this lecture. If struggling, don't hesitate to ask for clues.

The solution is trivial – find a better LED – but the client wishes to hear what you will be looking for in the new LED.

4. Premature failure of Li button cell batteries in a Bluetooth design

A design that uses a rechargeable lithium button cell battery as a source fails after about ten re-charge and discharge cycles. After the ten cycles it will not charge to anything like its specified open circuit voltage, and it discharges almost instantly. The mAh rating of the battery suggests that after each charge it should last at least half an hour. The battery is used to power a Bluetooth low energy (BLE) module.

Attempt to speculate what might be the problem and check that it is right with the person giving this lecture. If struggling, don't hesitate to ask for clues.

If it is desired not to replace the battery (because its size suits the application), can you suggest a circuit modification that might alleviate the problem.