

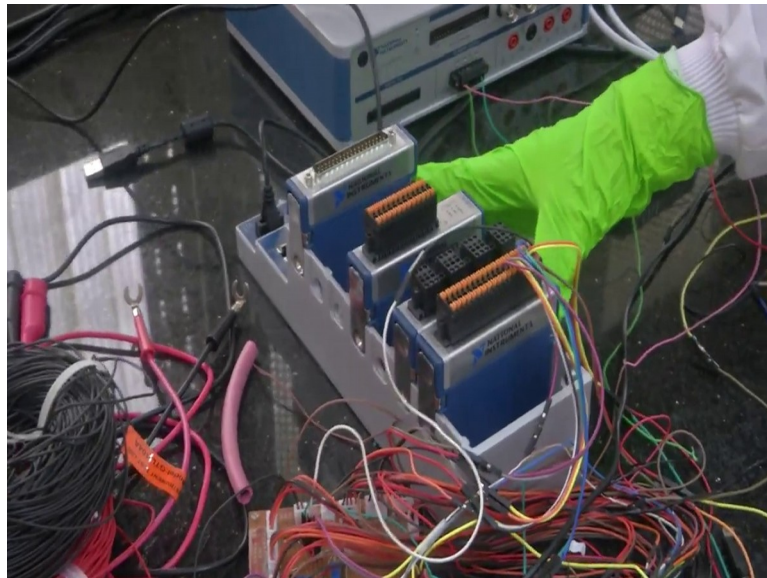
Sensors and Actuators
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Lecture - 11

[Introduction to Cleanroom Equipments: Micromanipulator, Stereo Microscope, metallurgical microscope, Incubator, Static Incubator, Inverted Microscope, Oven, Autoclave, Sonicator](#)

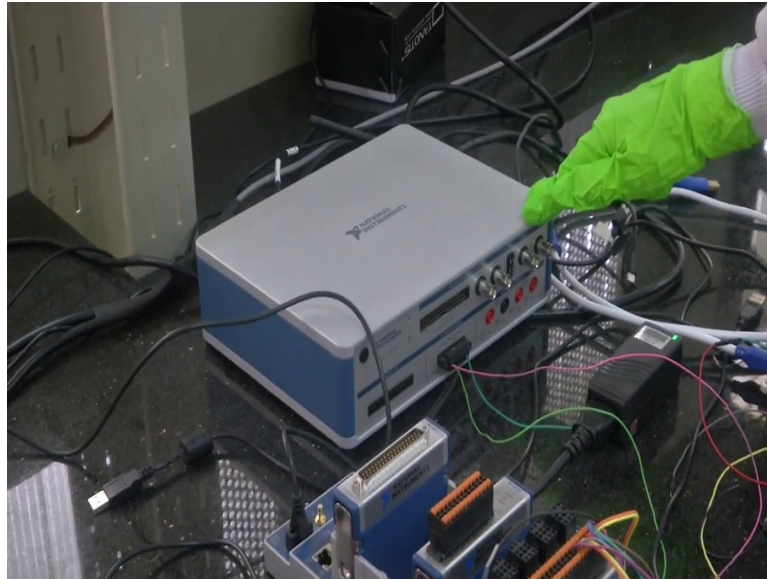
Any time when work on bacteria or cells, it is a good practice to autoclave the device or the samples before you throw in biological waste. An autoclave is like a pressure cooker it is similar to a pressure cooker, boiling water at a high temperature and that is why the particles or the bacteria or cells would die they kill the bacteria or cells that are leftover on to the in vitro platform which is a microfluidic chip or any other system. It is a good practice to kill those bacteria or cells if they are leftover a before you throw in the biological waste., that is autoclave, The NI DAQ system, it is for the data acquisition of different sensors fabricated.

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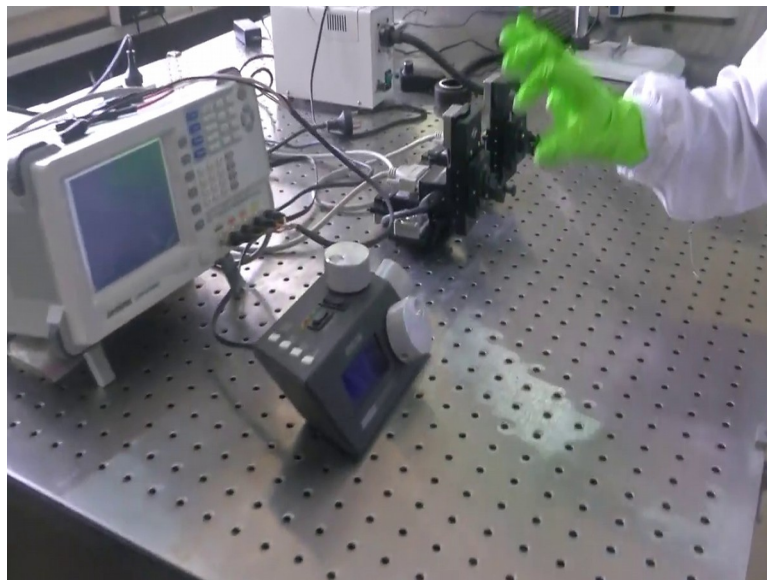
each of these is modules that go into the chase here.

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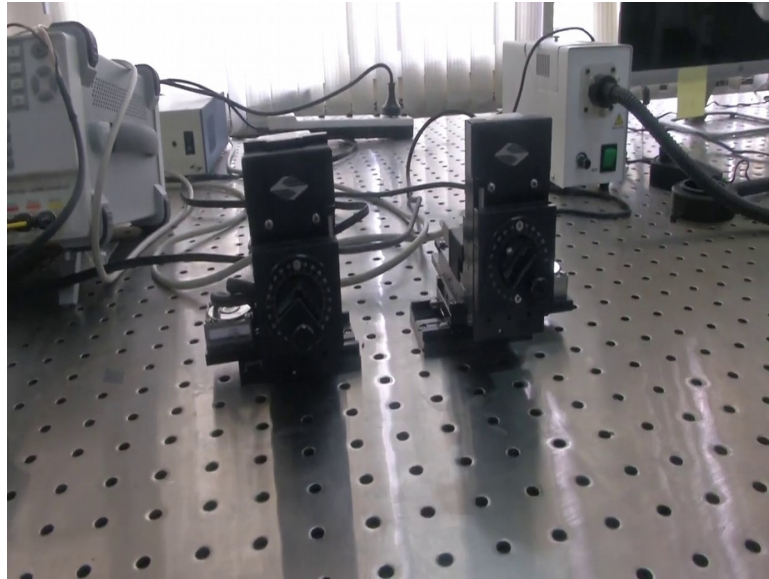
And this is the entire system, the virtual bench it can be used as a multi-source generator. It can also be used as a multimeter, dc voltage source.

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This is an anti-vibration table. the workstation avoids unnecessary vibration while working with microscope, micromanipulator, etc

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The micromanipulator with two arms and each of them can be controlled with micron-level precision., these are the probe sessions where you can put your probes and then use them for your work. There is a controlling probe for controlling the arms.

There is the LCR meter which measures the impedance values in various experiments and will help setting frequency for impedance measurements.

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There we have a stereomicroscope and a metallurgical microscope. So, again the choice of microscope for your study becomes important when you are talking about silicon chip

or MEMS-based devices which you are fabricated with silicon as substrate this is the choice of the microscope.

The metallurgical microscope becomes important and how the object is placed and how you can take images or even take videos using these microscopes and the different types of a lens which they can be used and the different magnification levels

HEPA filters are facing towards the characterization facility.

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now as in the biology section; we have the HEPA filter towers.

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, these two towers are facing in such a manner that the biology section has the air filtered in a proper manner.

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There are two types of incubators in the lab the shaker incubator and the static incubator. to maintain thus you have two levels of temperature and humidity depending on the sample for the appropriate growth of these samples have a shaker incubator where the samples are being vibrated at a certain rate and can set RPM.

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Desiccator is container equipment where you can put your devices just so that they are left for storage in a vacuum and the outside and air do not contaminate these devices. Like you know it is always interesting to know when you are talking about silicon or MEMS-based devices silicon substrate is it is always attracted to it is hydrophobic like it always attracts water or moisture. And what happens is the water once it gets settled on the surface of silicon, then it is contaminated, and device fabrication would really not give you fetch you with good results.

And hence to prevent all such contamination due to the external environment, you always store your devices into the desiccator like this. Use the pump and then maintain a vacuum inside this and leave it until you come back to the station and you carry them to another place maybe another facility, then you can easily carry these using the desiccator here.

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Here we have the hot plate with a temperature closely temperature control system, a magnetic vibrator as well. And why do we use the hot plate; again, an important step during the microfabrication process, soft baking. Every time you pin coat, you will have to bake and that is when you use the hot plate in order to remove the dissolved solvents in the photoresist that use pin coated. So, for that purpose, we have a hot plate here and then comes the microscope.

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What we have here is an inverted microscope. Again, the previous to microscope this stereo and the metallurgical microscope were used in the characterization facility. Here the inverted microscope becomes important because of cells and tissue sample the tendency to remain at the bottom of the petri dish or cell culture. It becomes important for you to have your lens at the bottom so that you can view them from the bottom of the petri dish. And with that motive, we have the inverted microscope here in the biology section. Moving forward after the microscope here, we have a microwave oven.

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when we are making microfluidic devices, you have PDMS polymer which is being used for moulding and for that you will have to bake them at 70 degrees Celsius for around 2 hours and for all that purpose we are using a microwave oven. And then on this part on this section of the biology section here, we have various like you see acetone, IPA, ethanol all of these are kept here.

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that was while when you want to clean your device even before fabricating use acetone and IPA. So, all of that has been contained into the rack here and then we have a sonicator. In case you want to have this again details about why what is a sonicator and how does it become an important part of you know fabrication facility all of that will be discussed, this here is a sonicator. And next we have an autoclave on one end, the autoclave is again basically used to every time you need to autoclave, or cleanse sanitize your devices, then that is when you use these autoclaves.

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Each of them will be brief to you in detail and the containers there for discarding the biohazard or in case want to discard the gloves or the devices discard them in a specified container.

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The most important equipment in the biology section is the biosafety hood and this is a level to BSL hood. And again, there are different levels and classification; it becomes important how you use the biosafety hood while you are working so that you the sash does not go beyond you know your hands or when you are working you make sure, just sit here and then you have the sash open and then just your hands remain exposed and then. At this level, you work so that there is no aerosol or another sort of contamination which could affect.

this is the biosafety hood and the details about the safety hood again will be explained in the future., this was all about how the biology section and the characterization facility are equipped with different types of equipment.