

## Printed Circuit Board (PCB) and Robotics Lab



### Introduction:

A **Printed Circuit Board** is a rigid structure that contains electrical circuitry made up of embedded metal surfaces called traces and larger areas of metal called planes. Components are soldered to the board onto metal pads, which are connected to the board circuitry. This allows components to be interconnected. A board can be composed of one, two, or multiple layers of circuitry. Circuit boards are built with a dielectric core material with poor electrical conducting properties to ensure pure circuitry transmission and interspaced with extra layers of metal and dielectric as needed. The standard dielectric material used for circuit boards is a flame-resistant composite of woven fiberglass cloth and epoxy resin, known as FR-4, while the metal traces and planes for the circuitry are usually composed of copper.

**Robotics** Lab, where innovation and creativity come to life! Our lab is dedicated to pushing the boundaries of technology through hands-on exploration and experimentation in the field of robotics. Here, we combine cutting-edge research with practical application to design, build, and test robotic systems that can tackle real-world challenges. Whether you're a seasoned engineer or a curious newcomer, our lab offers a dynamic environment for learning, discovery, and collaboration. Join us as we explore the future of automation and robotics, and unlock the potential of intelligent machines.

### Board Class:

Printed circuit boards are used for a variety of purposes. One distinguishing characteristic of PCBs is their class—either 1, 2, or 3. The class of PCB indicates its overall reliability and quality of design.

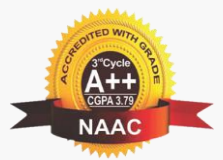
**Class 1:** Boards designate a consumer electronic.

**Class 2:** Boards are found in devices where high reliability is important, but not crucial. These devices try to minimize failure.

**Class 3:** Boards represent the most exacting manufacturing standards of a PCB. Simply put, if a Class 3 board fails, lives are immediately at stake—for example, the boards on an airplane.

### Types of Printed Circuit Boards

In general, printed circuit boards (PCBs) fall into three main types: rigid, flexible (flex), and metal-core. Rigid boards are the most commonly encountered by designers. These boards are constructed on a firm substrate through a lamination process involving high heat and pressure. The standard material used is FR-4, although it can be adjusted to enhance specific characteristics based on the design requirements. Flexible boards, in contrast, are made from pliable materials, allowing for significant flexibility. These boards are much thinner than rigid boards and resemble film in texture. Flexible PCBs are gaining popularity and are anticipated to play a crucial role in advancing wearable technology, offering designs free from the flat limitations of rigid boards. Metal-core



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PCBs, which are a variation of rigid designs, feature enhanced heat dissipation capabilities to protect sensitive components. They are particularly suited for high-current applications, helping to minimize thermal stress and prevent component failure.

### About PCB Design & Fabrication Lab:

Nvis PCB LAB is a complete solution for designing PCB. This solution includes all the necessary machines and chemicals which are used in the PCB development process. The PCB artwork film maker is used as a contact printer for creating design films from the PCB Layout. The artwork table is used for manually designing the films and for correcting or changing the existing films. The shearing machine is used for cutting the PCB according to film size. The photoresist dip coating machine is used for coating photoresist on the PCB Laminate. After photoresist coating, the PCB and films are placed in UV exposure machine for exposing. After exposing the development tank is used to remove unused photoresist. The dye tank is used for highlighting the design on the PCB. The etching machine is used for removing unused copper from the PCB. The drilling machine is used for making the holes in the PCB. The PCB design kit is provided which include tapes, stencils and other accessories used for designing the PCB.

### Instruments Details of PCB Design & Fabrication Lab:

#### 1) PCB Art Work Film Maker Nvis 180

This is a table top unit which serves as contact printer for developing the films. The films are used for further PCB development.

- Supply : 230V AC  $\pm$  10%, 50Hz
- Operating Mode : Manual / Automatic
- Timer : Adjustable from 1 Sec to 10 Sec with 1 sec interval
- Display : 16 x 2 LCD for timer and lamp status display
- Exposing area : 20" x 10"
- Buzzer : For timer indication
- Lamp indicator : Status of internal exposing lamp



#### 2) Artwork Table Nvis 181

This is a table top artwork and PCB inspection table with illumination lamp. This unit is used for art work designing and PCB corrections. This can also be used for designing small circuits. The illumination lamp provides uniform light which



is helpful in artwork by providing better light for working environment.

Supply : 230V AC  $\pm$  10%, 50Hz

Light Exposed area : 17" x 13"

### 3) PCB Shearing Machine Nvis 182

This machine is provided for cutting the PCB. This machine cuts the PCB with good efficiency and accuracy.

Mounting Base : Table Mounted / Floor Mounted

Cutting Area : 12"



### 4) Photo Resist Dip Coating Machine Nvis 183

The machine is table top and designed for the coating of Photoresist on the PCB Laminate. The Photoresist is used to cover the PCB Laminate Copper surface for further chemical development. This Photoresist is sensitive to Ultra Violet light.

Supply : 230V AC  $\pm$  10%, 50Hz

Timer : Adjustable from 1 Sec to 30 Sec at interval of 5 sec.

Display : 16 x 2 LCD for timer

Buzzer : For timer indication

Dipping area : 12" x 10"



### 5) UV Exposure Unit Nvis 184

This is a table top unit provided for the Photoresist coated PCB exposing. This unit is used for exposing the PCB. The PCB which is coated with the Photoresist is placed along with the film in this unit. This unit exposes the film on the PCB.

Supply : 230V AC  $\pm$  10%, 50Hz

Operating Mode : Manual / Automatic

Timer : Adjustable from 1 Sec to 20 min.

Display : 16 x 2 LCD for timer and lamp status display

Exposing area : 20" x 10"

Buzzer : For timer indication

Lamp indicator : Status of internal exposing lamp.



### 6) Dye Tank Nvis 185

This is a table top unit provided for dye coating on PCB. This unit is responsible for the visibility of the design on the PCB. This tank is filled with a solution which darkens the remaining Photoresist on the PCB. This machine highlights the design on the PCB.

- Supply : 230V AC  $\pm$  10%, 50Hz
- Timer : Adjustable from 1 sec to 30 sec at interval of 5 sec.
- Display : 16 x 2 LCD for timer
- Buzzer : For timer indication
- Dipping area : 12" x 10"



### 7) Development Tank Nvis 186

This is a table top unit which is provided for development of PCB. This unit is responsible for removing unused Photoresist from the PCB after the UV exposure. This tank is filled with chemical which removes unused Photoresist.

- Supply : 230V AC  $\pm$  10%, 50Hz
- Timer : Adjustable from 1 Sec to 30 Sec at interval of 5 sec.
- Display : 16 x 2 LCD for timer
- Buzzer : For timer indication



### 8) PCB Etching Machine Nvis 187

This is a table top unit for the etching of PCBs. This unit removes the unused copper from the PCB. This removal is carried by a chemical process which takes place in the machine.

- Motor : 1/16 HP Pressure pump
- Dipping area : 12" x 10"
- Mains Supply : 230V  $\pm$ 10%, 50Hz



### 9) Drill Machine Nvis 188

The drill machine is used for making drills in the PCB. This is provided with different size of drill bits for making drills in the PCB.

Supply	: 230V AC $\pm$ 10%, 50Hz
RPM	: 1500 which are adjustable in steps.
Drill bits	: 0.8mm - 5 Nos. 1.0 mm - 5 Nos.



### 10) Solderable Lacquer Tank Nvis 189

This is a table top unit which is used for protecting the PCB from environment. This chemical coated on PCB ensures protection for long time.

Supply	: 230V AC $\pm$ 10%, 50Hz
Timer	: Adjustable from 1 Sec to 30 Sec at interval of 5 sec.
Display	: 16 x 2 LCD for timer.
Buzzer	: For timer indication
Dipping area	: 12" x 10"



### 11) PCB Designer Kit Nvis 190

This kit includes tapes stencils which are helpful in designing the PCB.

CONTENTS:

1. Rotring Pens
2. Marker Pens
3. Magnifying Lens
4. Ruler
5. Stencils
6. Cutter
7. Adhesive Tape
8. Scrubber
9. Cleaning reagent



## 12) PCB Curing Machine Nvis 191

The PCB curing machine is used for curing the PCB Laminate after Photoresist coating. The curing machine is equipped with a hot air blower with auto cutoff facility.

Type	: Blower
Supply	: 230 V / 50 Hz
Heating area	: 12" x 12"



## 13) Accessories

All the accessories required given below are provided with Nvis PCB LAB.

Tray	: 5 Nos
Brush	: 2 Nos
PCB Laminate	: 10 Nos
Measuring Flask	: 250 ml
Clips	: 10 Nos
Hand Gloves	: 2 Pairs



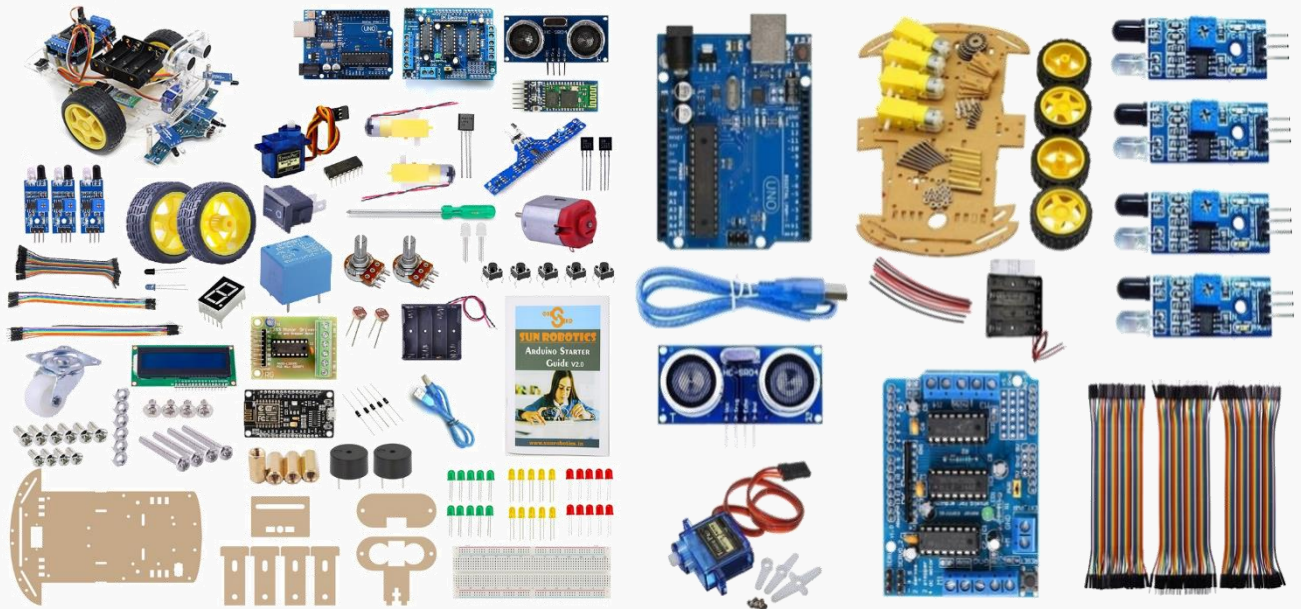
## 14) Chemicals

LPR Photoresist negative:	4 Ltr
LPR Thinner:	4 Ltr
Developer:	10 Ltr
Dye Blue:	10 Ltr
Cleaning Reagent 1 (alcohol):	2 Ltr
Cleaning Reagent 2 (Thinner):	2 Ltr
Solderable Lacquer:	2 Ltr
Developer Part A:	500 gm
Developer Part B:	500 gm
Lith Film Fixer:	500 gm
FeCl <sub>3</sub> :	5 Kg
Distilled Water:	5 Ltr



### Robotics Equipment and Tools:

- **Robotic Kits:** Modular systems and components for building and customizing robots.
- **Microcontrollers and Sensors:** Arduino, Raspberry Pi, or similar platforms, along with various sensors (e.g., cameras, distance sensors, accelerometers).
- **Actuators:** Motors, servos, and other components that enable movement.
- **Tools:** Soldering irons, screwdrivers, pliers, and other essential hand tools.



### Robotics Software and Programming:

- **Development Environments:** IDEs and software for programming (e.g., ROS, MATLAB, Python, C++).
- **Simulation Software:** Tools for modeling and simulating robotic systems (e.g., Gazebo, VREP, Webots).
- **Version Control Systems:** Git or similar systems for managing code and collaboration

### Power and Connectivity

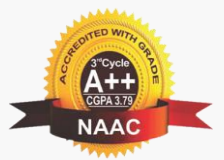
- **Power Supply:** Reliable sources of electricity and backup power.
- **Network Access:** Internet and local network connectivity for collaboration and research.



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**PCB Design & Fabrication Lab Photos:**



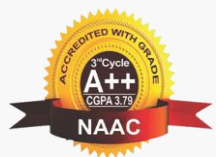




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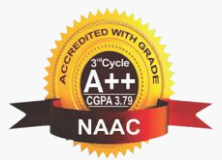
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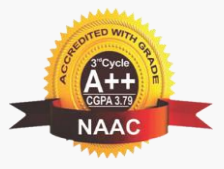




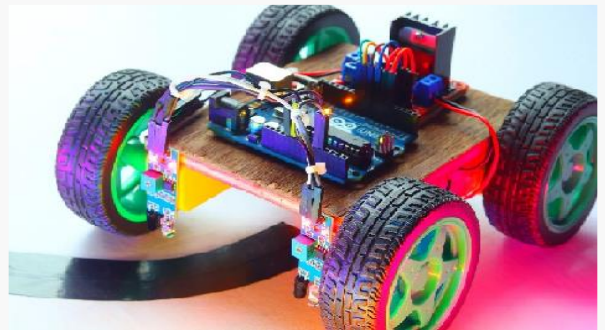
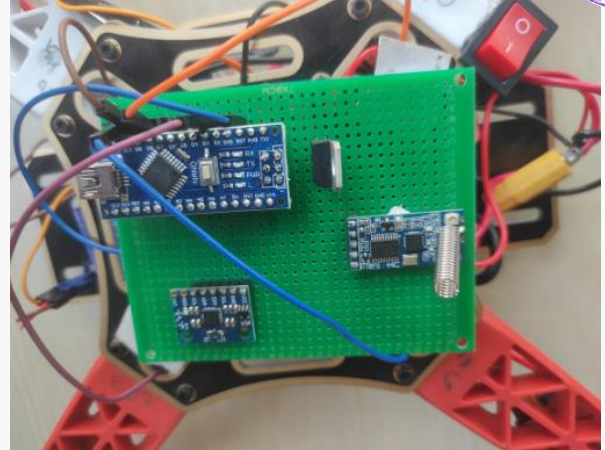
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Pooja Gunjal and Vishakha Dukle won 2<sup>nd</sup> prize at zonal level and was selected for university

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