



Electromechanical Systems Design with Semiconductors: Building a Drone

Introduction

All major universities worldwide have established MakerSpace Labs to impart hands-on experience to their students to conceptualize and build interesting student projects. Three years ago, IIT Bombay started MS101 MakerSpace as a first-year undergraduate compulsory course for all its first-year UG students. Expert faculty members from the Mechanical and Electrical Engineering departments lead the course. This program has been an enriching academic experience for IIT Bombay. As a result, the UG students in their first year get a flavour of engineering design. It has enabled students to conceptualize and build better projects in their senior years.

India is currently seeing a lot of industrial growth in semiconductor technology. Presently, Micron, Tata and CG Group have initiated IC packaging. With Tata embarking on an ambitious journey into IC manufacturing, India stands at the threshold of a remarkable transformation. This pioneering effort is poised to propel a surge in demand for a talented workforce in the semiconductor industry. The future looks bright, and the potential for growth is limitless!

IIT Bombay-MakerSpace and the IIT Bombay Centre for Semiconductor Technology (SemiX) are organising a two-week summer outreach course on **Electromechanical Systems Design with Semiconductors: Building a Drone**. This course is for students from other engineering colleges who have finished their first year of engineering.

The course includes lectures and hands-on laboratory experiments in basic mechanical engineering and electronics (including semiconductor technology). Students will also visit the IIT Bombay Nanofabrication Facility to learn about semiconductor research and development.

Course Objective

To give hands-on experience on basic Electronic circuits, Arduino interfacing, Mechanical design and fabrication skills, finally culminating in a drone project.

Course Content

Electrical Engineering: Lectures on basic electric networks, diodes, unregulated DC power supply, regulated DC power supply, logic gates and multiplexers (MUX), flip-flops, Arduino platform and basic

interfacing, Battery-Operated (BO) motor control.

Laboratory experiments on familiarization with bread boards, digital multimeter (DMM), digital storage oscilloscopes (DSO), Arbitrary Function Generators (AFG), RC filter, half wave and full wave rectifiers, unregulated and regulated DC power supplies, Transistor-Transistor Logic (TTL) IC interfacing, implementation of logic circuits using MUX, Synchronous counters, LFSR circuit, Arduino familiarization, analog and digital I/O, BO motor control.

Mechanical Engineering: Lectures on introduction to Fusion 360, sketching and visualization, orthographic projections, 3D solid modelling, components and assembly, generative design, simulation, and manufacturing.

Laboratory experiments on 3D modelling, generative design, mechanism modelling, prototype fabrication and assembly.

Course Project: Building a drone and flying it using a Joystick. This will involve soldering the Joystick PCB, making 3D printed landing gears, and assembling the drone, calibrating the Joystick and drone, and finally flying it. Last four days of the course will be devoted



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to the project. Students will be doing this project in groups of three.

Faculty

Faculty from the Electrical Engineering and Mechanical Engineering departments of IIT Bombay.

Course Eligibility

- Undergraduate engineering students who have finished their first or second year of study
- Faculty members teaching in engineering colleges

Course Dates

May 28, 2025 to June 10, 2025

(Total 10 Days, No Lectures or Labs on Saturdays and Sundays).

Venue for Lectures and Lab Sessions

Makerspace Lab, First floor, Transit Building (near BETIC and Electric Power House), IIT Bombay Academic Area

How to Register?

Registration to this course will be done in two stages.

Stage 1 Registration – It will involve giving your personal, course and college details to ensure that you have the required background. Selected participants will be informed by email and through mobile.

Fill the following Google Form. We shall communicate tentative acceptance to the course.

<https://forms.gle/uUSK7ieYMHgyjHJs8>



Stage 2 Registration - Formal registration (after receiving acceptance) by sending the course fee.

Once you receive the acceptance, you will be asked to send the required course fee and proof of payment. We shall send email and mobile confirmations of the final registration.

Course Fees

Rs. 25,000 for Students

Rs. 50,000 for Faculty

Note: Course fee Includes GST and complimentary lunch and snacks

Hostel Accommodation

Limited accommodation at IIT Bombay Hostels will be available on payment basis.

Contact Information

For any information and query regarding this outreach course, please contact us at makerspace.outreach@gmail.com

IITB MakerSpace Lab website:

<https://makerspace.iitb.ac.in>

Glimpses of MakerSpace Labs

