

Indian Institute of Technology Kanpur

Course Description

1. **Course No: DES634**
2. **Course Title: Electronics for Designers**
3. Per week Lectures: **3(L)**, Tutorial: **0 (T)**, Laboratory: **0 (P)**, Additional Hours [0-2]: **0 (A)**, Credits (3*L+2*T+P+A): **9** Duration of Course: **Full Semester**
4. **Proposing Department/IDP: Department of Design**
Other Departments/IDPs which may be interested in the proposed course: **Cognitive Science**
Other faculty members interested in teaching the proposed course: **None**
5. **Proposing Instructor(s): Dr. Gowdham Prabhakar**
6. **Course Description:**

This course will introduce the basics of electronics that are essential for the designers to prototype their conceptualised products. Moreover, a prior knowledge of these basics will help and influence the designers to foresee the functionality and feasibility of the product during ideation phase of the design. This course is structured in such a way that the candidates will learn these basics by practice-based learning. The candidates will be walking through designing a product from the scratch that deals with electronics, mechanics, and software design. Though this course deals with engineering techniques, it is designed to cater candidates from engineering as well as non-engineering backgrounds. The candidates will get exposed to multiple hardware platforms like Arduino, Raspberry Pi, NodeMCU (IoT module). The sessions will prepare the candidates for a clear understanding of the concept of sensors, signals, system, data, recording, processing, analysing, and inferencing. They will also get exposed to PCB design and rapid prototyping. At the end of the course, candidates will be prototyping their own product using their creativity and the skills learned from this course. The winning team will get an opportunity to work with any of the state-of-the-art trackers including eye-gaze tracker, hand-movement tracker, and full-body motion tracker.

a. Course Objectives:

- Introduce candidates to basic electronics
- Train them in Arduino
- Train them in using sensors and actuators
- Get hands-on in building hardware prototypes
- Learn the concepts by doing projects

b. Course Content:

S.No.	Topic	Details	Lectures
1	Introduction to Machines	<ul style="list-style-type: none">● Machines● Hardware Products● Software Products	3
2	Electricity	<ul style="list-style-type: none">● Electricity● Charge (q)● Current (I)● Potential (Volt)● Voltage (V)● Load/Resistance (Ohm) Multimodal Interaction	3

3	Ohms Law	<ul style="list-style-type: none"> • Current (I) • Voltage (V) • Load/Resistance (Ohm) • Ohm's Law 	3
4	Components	<ul style="list-style-type: none"> • AC/DC currents • Circuits • Active and Passive devices • Polarity • Resistors • DC Power Sources (Batteries) 	4
5	KVL, KCL	<ul style="list-style-type: none"> • Series and Parallel Resistors • Series and Parallel circuits • KCL and KVL • How to use breadboard • How to use multimeter 	4
6	Sensors, Actuators, Microcontroller	<ul style="list-style-type: none"> • Sensors • Actuators • Arduino 	6
7	Wireless connectivity (IoT)	<ul style="list-style-type: none"> • Socket Programming • Wired communication • Wireless communication • Applications 	4
8	Mechanism	<ul style="list-style-type: none"> • Motion • Mechanisms 	3
9	PCB Design	<ul style="list-style-type: none"> • PCB design tool (Eagle) • Printing • Etching • Drilling • SMD Soldering 	2
10	Final Project	<ul style="list-style-type: none"> • Pick up a problem statement • Bill of Materials and procurement • Prototyping • Project review meetings 	8
		Total Lectures	40

c. **Pre-requisites, if any:** None.

d. Short Summary:

This is an interdisciplinary course that trains students in designing and developing mechatronic products. It gives a foundation in building hardware products using Arduino or Raspberry pi with sensors and actuators. This course is structured in such a way that the candidates will learn the concepts by practice (design projects).

e. Recommended Books:

- <https://learn.sparkfun.com/tutorials/voltage-current-resistance-and-ohms-law>

- Horowitz, P., Hill, W., & Robinson, I. (1989). *The art of electronics* (Vol. 2, p. 658). Cambridge: Cambridge university press.
- Hayes, T. C., & Horowitz, P. (1989). Student manual for the art of electronics (No. 621.38 HAY). Cambridge, New York: Cambridge University Press.

Dated: 15-8-2023

Proposers: Dr. Gowdham Prabhakar

Dated:

DPGC Convener: