MS 101 Makerspace: Introduction

Dinesh K Sharma, Joseph John, Kushal Tuckley, PC Pandey

2023-24/I (Autumn)

Electrical Engg Department, IIT Bombay

MS 101 Makerspace

- The primary objective of this course is to inculcate a spirit of “making it by hand” among the students.
- It is meant to replace the earlier Engineering Drawing and Workshop courses (which were Institute UG Core Courses).
- At present ME and EE departments are jointly offering MS101.

- From the EE side you will learn basic circuit theory, passive and active devices, Operational amplifier circuits, Digital circuit basics, and Arduino board based interfacing techniques and controlling of motors.

Summary of EE Laboratory Activities

- During the first half of the semester, EE Experiments will involve
  - Use of Bread boards for assembling and testing of electronic circuits.
  - Use of Digital Multimeters (DMM) for measuring voltages and resistances.
  - Use of Waveform Generator (Tektronix AFG 1022) for generating test signals (sine and triangle waveforms).
  - Use of a Digital Storage Oscilloscope (Tektronix TBS 1072C) for for displaying and measuring time varying voltage signals.
  - Use of a DC Power Supply (Keithley 2231A Triple Channel DC Power Supply) to give the required DC Power Supply voltages to amplifier ICs.
  - Familiarization with the Arduino microcontroller board for doing basic interfacing and control of DC motors

2. Breadboard familiarization

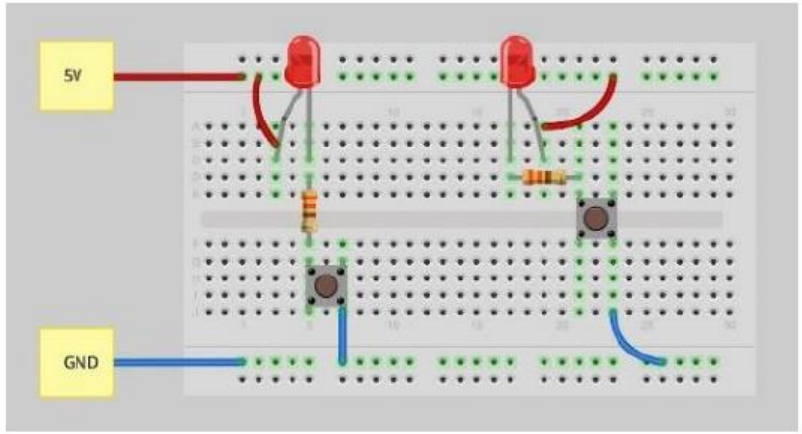


Fig 1.1 A Breadboard with a wired circuit

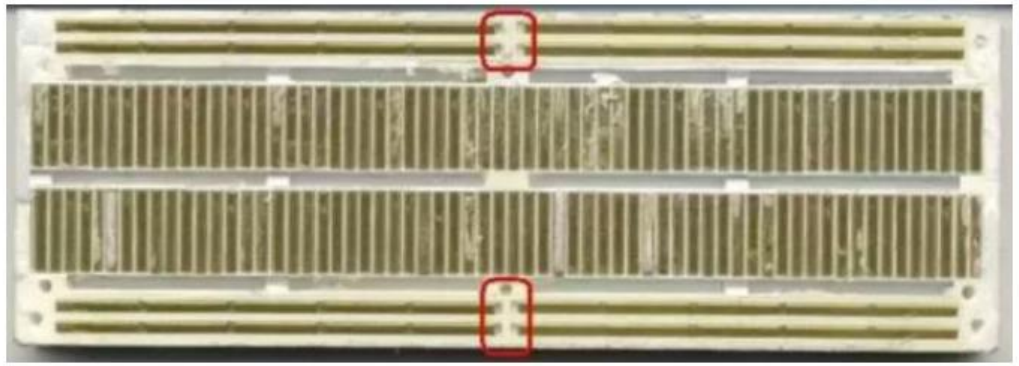
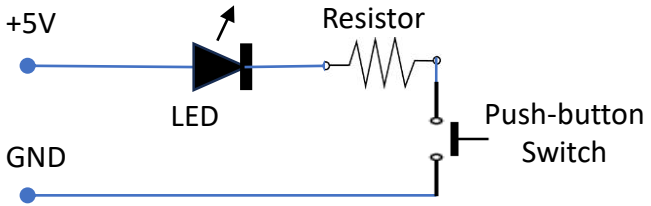
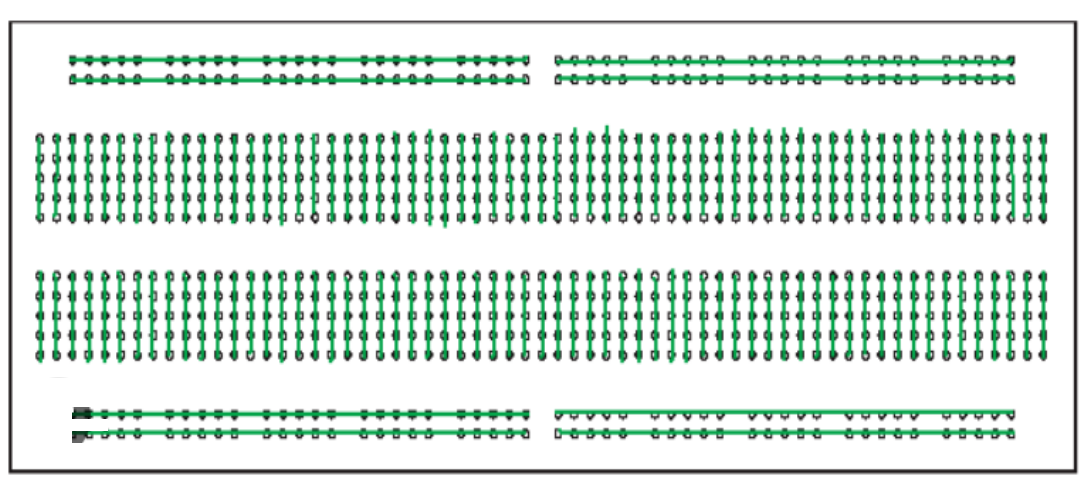


Fig 1.1B Typical Breadboard internal connections





1. Digital Multimeter

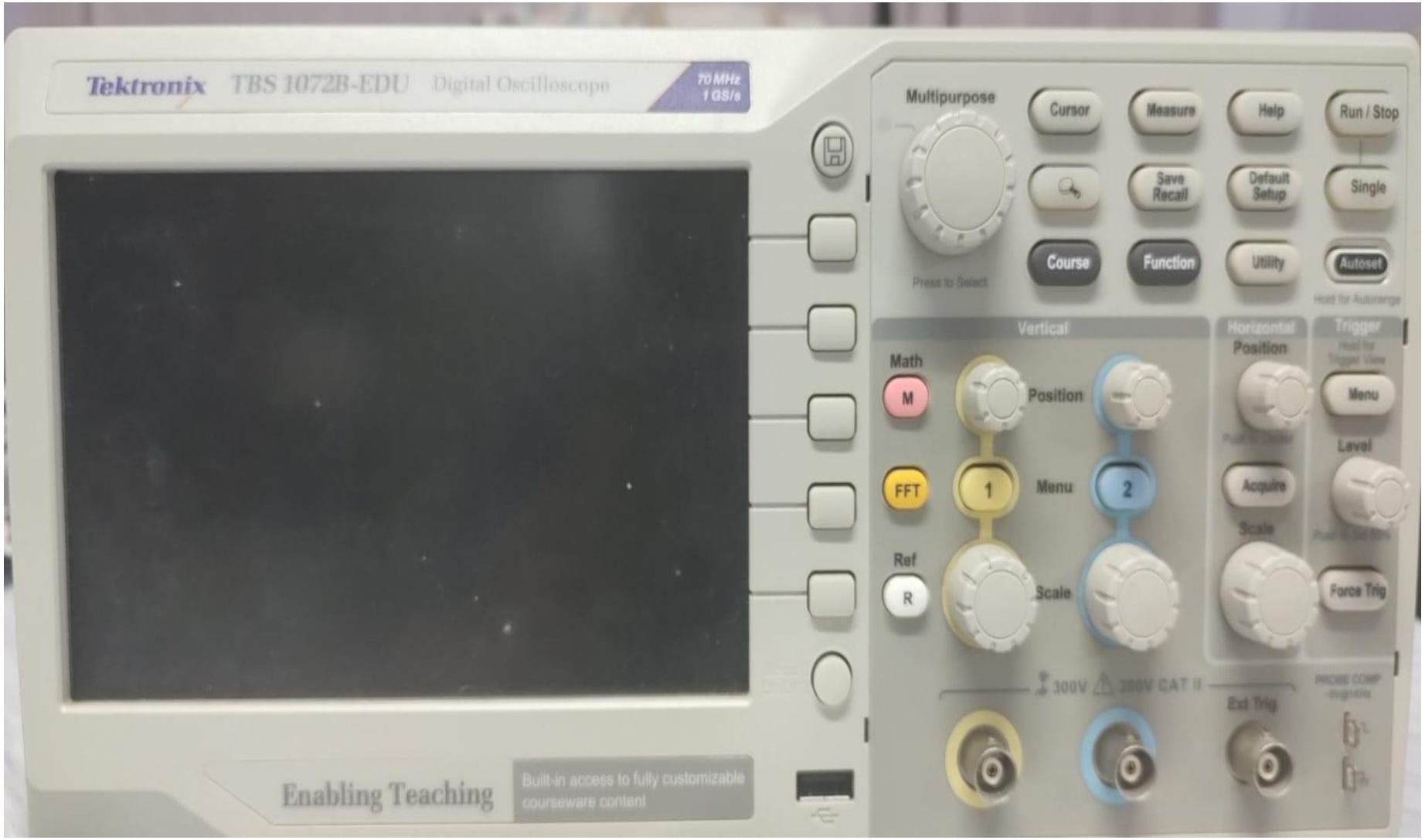
Fig 1 Front panel of Mastech 830L Digital Multimeter

- Used for measuring
  - Resistances
  - Voltages,
  - Currents
- Additional Features (commonly available)
  - Continuity check
  - Diode check

3. Arbitrary Waveform Generator (AFG-1022)

- Ensure that the Output setup has Hi-Z and NOT 50 ohms.
- To change:
  - Utility > output setup > Hi-Z

4. Digital Storage Oscilloscope (TBS-1072C)



…Summary of EE Laboratory Activities

- Second half of the semester
  - Design and implementation of the MS101 Project (involves application of all the learning of ME and EE)
  - Projects done in groups of six (assigned by us)
  - Projects done during the last 8 lab sessions of MS101
  - Progress of the project evaluated and marks awarded every week
  - Project demonstration and a viva voce during the last lab session of the semester.

- Project problem statement (for the current semester)
  - Will be announced in about two weeks

Course Weightages

- Quizzes : 20 % (10% ME and 10 % EE)
- Labs : 20 % (ME 7 labs and EE 5 labs)
- Midsemester Exam : 20 % (ME 12 %, EE 8 %)
- Project : 40 % (ME 10 %, EE 10%, Demo 20 %)

- Project problems:
  - 2022-23/I - Autumn semester – Line Follower with extra mechanical task
  - 2022-23/II - Spring semester – BOT for Mountain Cargo delivery (a track with 10 deg, 20 deg and 30 deg slopes)

EE Schedule of MS 101 (till end of August)

Faculty wise Sections and Batches:

- P1 and P2 (Batches B1, B2, B3) - Prof Dinesh K Sharma (DKS)
  - Labs : Mon and Thu 2-5pm
- P3 and P4 (Batches B4, B5, B6)- Prof Kushal Tuckley (KT)
  - Labs: Tue and Fri 2-5pm
- P7 and P8 (Batches B7, B8, B9)- Prof PC Pandey (PCP)
  - Labs: Mon and Thu, 8:30-11:30am
- P9 and P10 (Batches B10, B11, B12)- Prof Joseph John (JJ)
  - Labs: Tue 8:30-11:30, Fri 9:30-1230

EE Lect 1 Schedule: Aug 7 Mon and Aug 8 Tue

- Intro + Lect 1 - Aug 7, Mon: B9 in ESE, 8:30-10:00am; B7 and B8 in DH from 10:00-11:30am
- Intro + Lect 1 - Aug 7, Mon: B3 in ESE, 14:00-15:30am; B1 and B2 in DH from 15:30-17:00 hrs
- Intro + Lect 1 - Aug 8, Tue: B12 in ESE, 8:30-10:00am; B10 and B11 in DH from 10:00-11:30am
- Intro + Lect 1 - Aug 8,Tue: B6 in ESE, 14:00-15:30am; B4 and B5 in DH from 15:30-17:00 hrs

EE Lect 2 Schedule: Aug 9 Wed

- Lect 2 - Aug 9 Wed, 8:30-9:25am, B1, B2, B3 - Prof DKS, LA001
- Lect 2 - Aug 9 Wed, 8:30-9:25am, B4, B5, B6 - Prof KT, LA002
- Lect 2 - Aug 9 Wed, 8:30-9:25am, B7, B8, B9 - Prof PCP, LA201
- Lect 2 - Aug 9 Wed, 8:30-9:25am, B10, B11, B12 - Prof JJ, LA202

No EE Labs from Aug 10 Thu – Aug 15 Tue

During Aug 10 – 15, ME Lab Expt 1 will be held

EE Lect 3 Schedule: Aug 11 Fri

- Lect 3 - Aug 11 Fri, 8:30-9:25am, B1, B2, B3 - Prof DKS, LA001
- Lect 3 - Aug 11 Fri, 8:30-9:25am, B4, B5, B6 - Prof KT, LA002
- Lect 3 - Aug 11 Fri, 8:30-9:25am, B7, B8, B9 - Prof PCP, LA201
- Lect 3 - Aug 11 Fri, 8:30-9:25am, B10, B11, B12 - Prof JJ, LA202

EE Lect 4 Schedule: Aug 16 Wed

- Lect 4 - Aug 16 Wed, 8:30-9:25am, B1, B2, B3 - Prof DKS, LA001
- Lect 4 - Aug 16 Wed, 8:30-9:25am, B4, B5, B6 - Prof KT, LA002
- Lect 4 - Aug 16 Wed, 8:30-9:25am, B7, B8, B9 - Prof PCP, LA201
- Lect 4 - Aug 16 Wed, 8:30-9:25am, B10, B11, B12 - Prof JJ, LA202

EE Lect 5 Schedule: Aug 18 Fri

- Lect 5 - Aug 18 Fri, 8:30-9:25am, B1, B2, B3 - Prof DKS, LA001
- Lect 5 - Aug 18 Fri, 8:30-9:25am, B4, B5, B6 - Prof KT, LA002
- Lect 5 - Aug 18 Fri, 8:30-9:25am, B7, B8, B9 - Prof PCP, LA201
- Lect 5 - Aug 18 Fri, 8:30-9:25am, B10, B11, B12 - Prof JJ, LA202

EE Expt 1 Schedule

- Expt 1 - Aug 17 Thu, Prof PCP - B7, B8 - in DH, 8:30-11:30am
- Expt 1 - Aug 17 Thu, Prof DKS - B3 - in ESE 101 and 108, 2-5pm
- Expt 1 - Aug 18 Fri, Prof JJ - B10, B11 - in DH, 9:30 am -12:30pm
- Expt 1 - Aug 18 Fri, Prof KT - B6 - in ESE 101 and 108, 2-5pm
- Expt 1 - Aug 21 Mon, Prof PCP - B9 - in ESE 101 and 108, 8:30-11:30am
- Expt 1 - Aug 21 Mon, Prof DKS - B1, B2 - in DH, 2-5pm
- Expt 1 - Aug 22 Tue, Prof JJ - B12 - in ESE 101 and 108, 8:30-11:30am
- Expt 1 - Aug 22 Tue, Prof KT - B4, B5 - in DH, 2-5pm

EE Quiz 1 Schedule

- EE Quiz 1 - Aug 23 Wed, 8-9am
- Written Quiz
- Syllabus: EE Lect 1 to 5
- Rooms: LA001, LA002, LA201, LA202, LH101 and LH102
- Seating arrangement will be announced later

EE Lab Rules

- 100% Attendance in Labs compulsory
- Arrive at least 5 min before at the Lab venues. Late comers will have mark penalty
- Wear proper dress as per MS101 Lab instructions

- EE Lab expts done in groups of two (as per the given list)
  - Half the expt will be carried out by one member and the other half by the second member.
  - Come fully prepared by going through the EE Lab expt handout.

- Each one should have his/her Lab Record (a dedicated note book to record observations and results of each experiment)
  - Mark penalty for not bringing your Lab record

- Your TAs will evaluate your Lab preparation and performance and award you marks out of 10.

List of EE Tool Set + Arduino Board Accessories

- Digital Multimeter
- Bread board (see the figure on next slide)
- Wire Stripper
- Flat Screw driver (5 mm or 4 mm)
- Nose Plier (small one for general use – soldering, straightening wires etc)
- Forceps (for holding Ics and other components)
- Arduino Uno Board
- L298 Motor Controller Board (for driving two motors)
- BO Motors (60 – 200 rpm)
- Male-to-female interconnecting wires – 4 nos

Tool set for Electronics Lab

Digital Multimeter (DMM)

Wire Stripper

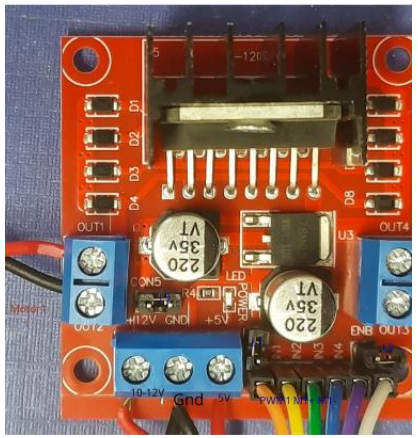
ESD angled tweezer

Solderless Breadboard

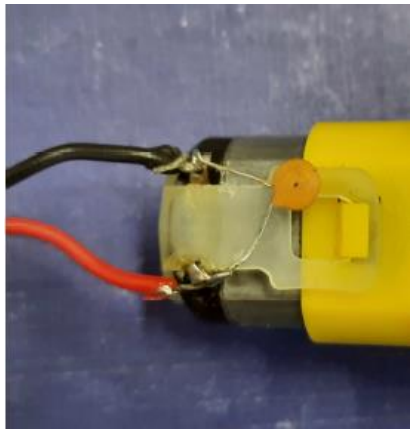
Flat Tip Screwdriver

Nose Plier

Arduino Uno Rev 3 + USB Cable



L298 Motor Driver



BO Motor