Prelab 1A  F → MF
Tutorial Thursday 2:30
Lab 1A now posted.

As per outline → Lowest grade in prelab will be dropped.

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Electrical Safety (Continued)

Microshock vs. Macroshock

> 1 mA → dangerous

电流 spreads out through the skin
(small amount goes through heart)

Current goes through the heart b/c of intercardiac cathoder

MA → dangerous

Macroshock → ground fault  ①

3rd prong

→ current goes through chassis in case of fault

Classes of Equipment

Class I, Class II, Class III (on the slides)

SELV

↓ ① ∇ ①
**Electrical Safety Test**

- A sample of devices sent to labs
- Samples are tested against a # of tests

**Isolation**

- Isolation amplifiers

**Electrical Isolation**

**Isolation Technologies**

- magnetic
- optical
- Transformers
- Opto isolator

Examples on Slide 1.28 + Sample test Qs on other pages.

*We will use optocouplers in this course.*

**Reading Spec Sheets**

Contains info on the features, compliance, pin outs, etc.

Look at compliances to determine tests passed.

**Pinout Ex**

<table>
<thead>
<tr>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
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<td>1</td>
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<td>2</td>
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[Diagram of pinout]

*(Not used in this course)*

*Also, check abs. max ratings.*

*(gives great insight into which part to pick)*
**Opto-isolator**

Diode

\[ \text{Value} \rightarrow \text{one way flow} \]

**Mech analogy**

\[ \text{mitral value} \]

\[ \text{Heart} \rightarrow \text{Parteral} 120 \text{ mmHg} \]

\[ \text{Stenosis} \]

\[ 160 \text{ mmHg} \]

One way flow drops by \( \approx 0.7 \text{ V} \) as current crosses diode.

**Ex.**

\[ 1V \times 1K \Omega \]

\[ V_D = 0.7 \text{ V} \]

\[ +1V - iR - V_D = 0 \]

\[ i = 300 \text{ mA} \]

**Light Emitting Diode (LED)**

\[ \text{Power from } (V_D)i \text{ emitted as light} \]

\[ V_D = 10 \text{ SV} \]

\[ IR \]

\[ 2.5 \text{ V} \text{ visible} \]

**Simple Transistor Model**

If diode ON, transistor man closes the switch. (if i flow through diode)
Opto-transistor

Optoisolator \equiv \text{opto-transistor}

Electrical isolation

Ex. Normal

Case 1: Coffee spill (120V)

Case 2: Lightning (1 MV)

Switches

usually 3 pins

NO \rightarrow \text{Normally open}
  closes when pushed

NC \rightarrow \text{Normally closed}
  opens when pushed

If sees light, closes switch.

Patient OK

transistor burns out

current jumps gap

Patient Shocked

1 MV
Relay

A magnetic wire closer.

If curr. through AA', C pulled to D
NO → C+D
NC → B+C

Now want, when i into CC', relay switches.

Inductor

\[ \frac{\mathrm{d}i}{\mathrm{d}t} \]

\[ V = L \frac{\mathrm{d}i}{\mathrm{d}t} \]

\[ i \]

\[ V \rightarrow -\infty \text{V to prevent destroying; refer to } \]