

Basic Electronics

(ES-301)

MARBELLA INSTITUTE OF TECHNOLOGY

Course Utility

Basic Electronics is a solid base for understanding of individual electronic components and how they can interact with each other for building utilities

Course Purpose

Basic Electronics is for the student that initiates in electronics, and wants to gain confidence thru highly-practical projects. The projects are related to each-other, allowing progressive complexity. The students can test, monitor and control components, mostly with Arduino platforms which are the fastest developing and most versatile products of today's electronic market.

Text Book

This intuitive guide shows how to wire, disassemble, tweak, and re-purpose everyday devices quickly and easily. Packed with full-color illustrations, photos, and diagrams, Hacking Electronics teaches by doing--each topic features fun, easy-to-follow projects. Discover how to hack sensors, accelerometers, remote controllers, ultrasonic rangefinders, motors, stereo equipment, microphones, and FM transmitters. The final chapter contains useful information on getting the most out of cheap or free bench and software tools.

- Safely solder, join wires, and connect switches
- Identify components and read schematic diagrams
- Understand the how and why of electronics theory
- Work with transistors, LEDs, and laser diode modules
- Power your devices with a/c supplies, batteries, or solar panels
- Get up and running on Arduino boards and pre-made modules
- Use sensors to detect everything from noxious gas to acceleration
- Build and modify audio amps, microphones, and transmitters
- Fix gadgets and scavenge useful parts from dead equipment

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COURSE OUTLINE

UNIT 1 **Getting Started**

Class

- 1 Getting stuff
- 2 How to strip a wire
- 3 How to join wires together by twisting
- 4 How to join wires by soldering
- 5 How to test a connection
- 6 How to hacking a computer fan to keep soldering fumes away

UNIT 2 **Theory Guides**

Class

- 7 How to assemble a starter kit of components
- 8 How to identify electronic components
- 9 What are current, resistance and voltage?
- 10 What is power?

UNIT 3 **Basics**

Class

- 11 How to make a resistor get hot
- 12 How to use resistors to divide a voltage
- 13 How to convert a resistance to a voltage
- 14 How to hack a push light to make it light sensing
- 15 How to choose a transistor
- 16 How to use a power MOSFET to control a motor
- 17 How to select the right switch

UNIT 4 **Led Hacks**

Class

- 18 How to stop an LED burning out
- 19 How to select the right LED for the job
- 20 How to use an LM317 to make a constant current driver
- 21 How to measure the forward voltage of an LED
- 22 How to power large numbers of LEDs
- 23 How to make LEDs flash
- 24 How to use stripboard (LED flasher)
- 25 How to use a laser diode module
- 26 Hacking a slot car racer

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Unit 5 **Batteries and Power**

Class

- 27 Select the right battery
- 28 Charging batteries (in general)
- 29 How to charge a NiMh Battery
- 30 How to charge a sealed lead acid battery
- 31 How to charge a LiPo Battery
- 32 Hacking a cell phone battery
- 33 Controlling the voltage from a battery
- 34 Boosting voltage
- 35 Calculating how long a battery will last
- 36 Battery backup
- 37 How to use solar cells

Unit 6 **Arduino Hacks**

Class

- 38 How to set up Arduino (and blink an LED)
- 39 How to make an Arduino control a relay
- 40 How to hack a toy for Arduino control
- 41 How to measure voltage with Arduino
- 42 How to use Arduino to control an LED
- 43 How to play a sound with an Arduino
- 44 How to use Arduino Shields
- 45 How to control a relay from a web page
- 46 How to use an Alphanumeric LCD shield with Arduino
- 47 How to drive a servo motor with an Arduino
- 48 How to Charlieplex LEDs
- 49 How to use a 7-segment display with an Arduino (I2C)
- 50 How to make an automatic password typer

Unit 7 **Module Hacks**

Class

- 51 How to use a PIR motion sensor module
- 52 How to use ultrasonic range finder modules
- 53 How to use a wireless remote module
- 54 How to use a wireless remote module with Arduino
- 55 How to control motor speed with power MOSFET
- 56 How to control motors with an H-bridge module
- 57 How to control a stepper motor with an H-bridge module
- 58 How to make a simple robot rover
- 59 How to use a 7-segment LED display module
- 60 How to use a real time clock module

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Unit 8 **Hacking with sensors**

Class

- 61 How to detect noxious gas
- 62 How to measure something's color
- 63 How to detect vibration
- 64 How to measure temperature
- 65 How to use an accelerometer
- 66 How to sense magnetic fields

Unit 9 **Audio Hacks**

Class

- 67 Hacking audio leads
- 68 How to use a microphone module
- 69 How to make an FM bug
- 70 Selecting loudspeakers
- 71 How to make a 1W audio amplifier
- 72 How to generate tones with a 555 timer
- 73 How to make a USB music controller
- 74 How to make a software VU meter

Unit 10 **Take Electronic Devices Apart**

Class

- 75 How to avoid electrocution
- 76 How to take something apart AND put it back together again
- 77 How to check a fuse
- 78 How to test a battery
- 79 How to test a heating element
- 80 Finding and replacing failed components
- 81 How to scavenge useful components
- 82 How to reuse a cell phone power adapter

Unit 11 **Tools and Testing**

Class

- 83 How to use a multimeter (general)
- 84 How to use a multimeter to test a transistor
- 85 How to use a lab power supply
- 86 Introducing the oscilloscope
- 87 Software tools