

Objective of Development of Electronics trainer kit:

- ☐ To remove the fear of Electronics, among Students.
- ☐ To create interest and motivation to become Electronics Engineers.
- ☐ To motivate for new innovative ideas towards Energy efficient, Automation and Smart control.
- ☐ To create hardware design/ Troubleshooting Engineering Manpower for the nation.
- ☐ To become strong in concepts of Electronics from school level and up to engineering degree level.
- ☐ To verify Theory in Practical and enjoy the Electronics.
- ☐ To give boost and confident to the students preparing for Competitive exams by practically verifying the results of any circuit.
- ☐ To implement and check self-design ideas and mini projects using different areas of Electronics using single kit.
- ☐ To become familiar with Sensors used in Automation and control in Home appliances, Automobiles, Biomedical Instruments and Industrial controls etc.

Limitations of Commonly Available Electronics kits in Market:

- ☐ Large in Size and Weight
- ☐ Needs external source and measuring instruments
- ☐ Covers only specific area of Electronics
- ☐ Can perform only Limited number of Experiments
- ☐ Experiments can be performed only in the laboratory
- ☐ Need Large experimental Area for supporting instruments
- ☐ High in cost

Innovative Features of IITM Developed Universal Electronics Trainer kit:

- ☐ Portable in size (A4 Size) and less weight (2.5 kg) and one can easily carry as brief case.
- ☐ Does not need any external supporting instruments.
- ☐ Experiments can be performed in any Room (Separate Laboratory not needed).
- ☐ Built-in DC Power source, Variable voltage source, Oscilloscope, Signal generator and Voltage/ Current measuring meter.
- ☐ High Efficiency, Wide AC input voltage range (160V to 280V) DC Power source is used considering power fluctuation in Rural Areas.
- ☐ All field of Electronics are covered (Basic Electronics, Analog, Digital, Solar PV Power, Sensors and Embedded controller)
- ☐ Provided with Input Devices like Toggle / Push button Switches and Output Devices like Light emitting diode (LED) for status indication, LCD for parameter display, Buzzer for alarm indication, Electromagnetic Relay switch for output controls, Speaker for sound level indication, Bar graph display for voltage level indication, mini DC fan and mini DC motor.
- ☐ Sensors to monitor different parameters like Temperature, Light, Sound, Distance, Magnetic field and Heart beat are used.
- ☐ Nearly 300+ Experiments can be performed.
- ☐ Provision of Breadboard at centre – To wire any circuit and use with built-in power source, signal generator, Oscilloscope, sensors and Arduino microcontroller.
- ☐ Experiment covers from fundamentals of Electronics (Laws and Theorems) upto Application based circuits.
- ☐ Easy to integrate different blocks to perform their own mini projects.
- ☐ Provision of external port pins of Arduino microcontroller – To perform external Automation/ control/ Robotics Experiments.
- ☐ Cost effective.

High lights of Supporting Manual of Electronics Trainer kit:

- ☐ Manual is framed as self-practice by students with necessary wiring diagrams.
- ☐ Manual starts with a Quick Overview of the Trainer System, describing the various functional blocks and their locations.
- ☐ Sufficient back ground Theory is given for better understanding.
- ☐ Measurement tables are given with theoretical values to verify practical results.
- ☐ Plots are given for quick analysis as well as the conclusion.
- ☐ Wherever required, experiments are provided with numerical exercises to understand the theory strong.
- ☐ Specifications, Characteristics and functions of each component are discussed in detail.
- ☐ Self-Assessment questions are given to gain confident.
- ☐ Appendix is given to recollect basics and apply in relevant experiments.
- ☐ The range of topics covered, start from Basic electric circuits, test and measuring instruments, electronic components, semiconductor devices, transistor circuits, Analog Circuits, digital electronics, Solar photo voltaic as renewable energy source, Input-Output devices, sensors and actuators till the embedded controller using Arduino UNO. Last two chapters are devoted to the application-based exercises as relevant for the use in our day-to-day life.
- ☐ List of Dos and Don'ts and Safety Practice are given.
- ☐ Needs only minimum guidance and provides great confidence.
- ☐ Manual is prepared with the motive of imparting the required Knowledge and Skill competencies so as to nurture the students to build and develop their own electronic circuitry and systems in future....

Electronics World - Universal Electronics Trainer Kit, Designed and developed by IIT Madras

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Limitations of Generally Available Electronic trainer kits:

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- ☐ Portable in size (A4 Size) and less weight (2.5 kg) and one can easily carry as brief case.
- ☐ Does not need any external supporting instruments.
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- ☐ Built-in DC Power supply (+5V, +12V, and -12V), Variable voltage source, Oscilloscope, Signal generator and Voltage/ Current measuring meter.
- ☐ High Efficiency, Wide AC input voltage range (160V to 280V) DC power supply is used considering power fluctuation in Rural Areas.
- ☐ Almost all area of Electronics covered (Basic Electronic Circuits, Analog, Digital, Solar PV Power, Sensors and Embedded controller)
- ☐ Provided with Input Devices like Toggle Switches/ Push button Switches and Output Devices like Light emitting diode (LED) for status indication, LCD for parameter display, Buzzer for alarm indication, Electromagnetic Relay switch for output controls, Speaker for sound level indication, Bar graph display for voltage level indication, mini dc fan and mini DC motor.

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- Experiment covers from fundamentals of Electronics (Laws and Theorems) upto Application based circuits.
- Easily integrate different blocks to perform mini projects.
- Provision of external accessible port pins of Arduino microcontroller – To perform external Automation/ control/ Robotics Experiments.
- Low cost.

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- Manual is framed as self-practice by students with necessary wiring diagrams.
- Manual starts with a Quick Overview of the Trainer System, describing the various functional blocks, and their locations.
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DESIGN FEATURES IN THE ELECTRONICS TRAINER KIT

- ❖ Provision of few necessary tracks to reduce external wiring and those are given in top layout print.
- ❖ Provision of 4 SPDT switches to give logic 0 or 1 (0V or 5V) .
 - In addition, LED indication is provided at the Switch output to view the logic state of selection to minimize external wiring.
 - Also 4 additional Jumper selection to select logic 0 or 1 with total of 8 digital logic inputs provision.
- ❖ Provision of Push button switches with Pull up Resistor to avoid noise pickups at the digital inputs during open state.
- ❖ Provision of 4 Red LEDs and 4 Green LEDs to check the output logic level of digital circuits.
 - Built-in series SMD resistor is provided with LED to avoid external wiring and to avoid Failure by direct connection mistake.
- ❖ Each section is provided with additional Ground pins for ease connection
- ❖ Flip flop section with blocks printed -makes less wiring and ease understanding of circuits as in text book.
- ❖ Provision of builtin SMD LEDs with series resitors at the output of JK flipflops to view the logic status during circuit operation to minimize indication wiring.
- ❖ Jumper arrangements in Flip- Flop section is provided such that easy wiring of different types of sequential circuits.
- ❖ Provision of Push button switches and 555 multivibrator section near the flipflop section for easy feeding of individual clock pulse. delayed clock pulse and continuous clock pulse.
- ❖ Provision of Logic Gates Symbol printed and input- output terminals – For ease understanding of circuits as in text book

- ❖ Provision of external terminals for additional gates for future expansion connection
- ❖ Provision of decoupling capacitors at IC supply pins to eliminate spikes/ Noises
- ❖ Isolated Power selection for each block to minimize power consumption and unnecessary loading of unused blocks.
- ❖ Isolated Analog and Digital Ground to minimize noise pickup and to avoid ground loop problems.
- ❖ Single Opamp section with jumper selection and symbol so as to wire the circuits easily
- ❖ Fixed below SMD networks are provided, to avoid complex wiring in bigger circuits
 - R-2R Ladder Digital to Analog converter
 - Wein Bridge Osc
 - R-C Phase shift Osc
- ❖ Quad Opamp is provided with symbols one below the other with 4 output voltage network nearby to enable the easy wiring of additional circuits
- ❖ Single supply and Dual supply selection jumper is provided in the supply terminals of Quad opamp to enable specified application.
- ❖ Provision of common opamp and sensors near by and Prefixed SMD voltage divider network, and variable voltage provision in sensor section to practice many application oriented experiments.
- ❖ Other opamp terminals provided externally for future additional circuit practice.
- ❖ Arduino Experiments are framed such that input and output ports of many experiments should not clash.
- ❖ Separate ports are allotted for each sensors, switches, LED and LCD
- ❖ Port pins are taken out externally for future new experiment practice.
- ❖ Motor driver IC additional outputs are taken externally for future Robotics Expt
- ❖ Arduino Programming provision is given
- ❖ Supply isolation is given when both Arduino programming port and kit is powered, to protect reverse feed to Arduino USB
- ❖ Sensor arrangements such that both analog experiments and Arduino experiments can make use of it.
- ❖ Provision of separate Input -Output Devices to build various circuits with control and Monitoring (Push button Switches, Membrane switches, LEDs, LCD, Electromagnetic Relay, Buzzer, mini DC fan, Mini DC motor, Mic and Speaker)
- ❖ Fixed LCD arrangement with dedicated ports for measurement of different Physical and Electrical parameters.
- ❖ Group of LEDs are provided and with jumper selection different combination of below experiments can be performed-
 - LED Blinking
 - Switch Debouncing
 - Police chaser
 - Traffic light system
 - VIBGYOR Colour generation
- ❖ Provision of ZIF socket for additional IC placement without braking
- ❖ Provision of 4 Pins of 5v and 4 pins of ground in nearby ZIF socket for fixed logic input connection
- ❖ Breadboard provision at centre for any circuit wiring to use with builtin supply, signal generator, Oscilloscope, sensors, Arduino
- ❖ Transformer provision for linear power supply experiments
- ❖ In built Power supply with 5V, +12V and -12V outputs for both Analog and Digital Experiments.
- ❖ Variable power supply from 0 to 6V for Device characterization.

- ❖ In built Function Generator to feed different wave shape(Sine, Square, Triangle and Pulse) signals with variable Amplitude and frequency.
- ❖ Provision of Mini Digital Oscilloscope fitted inside the kit for signal measurement
- ❖ Provision of Digital Panel meter fitted inside the kit to measure Voltage and current
- ❖ Capacitance measurement using Arduino with Automatic Selection with unit indication in pico farads, nanofarads, and microfarads.
- ❖ Resistance measurement in Arduino with Automatic unit selection and display.
 - In case of non availability of DMM.

Sensors Used:

- Light Sensors – Light Dependent Resistor (LDR), Infrared Sensor, Solar cell
- Temperature Sensors – Thermistor, Thermocouple and LM 35
- Sound Sensor – Microphone
- Distance Sensor – Ultra sound Sonar
- Magnetic field Sensor- Hall effect sensor, Reed Switch

Application based circuits covered:

- Automatic Dusk-Dawn sense Street light controller using LDR
- Solar operated DC fan
- Object Detector using IR Emitter – Detector
- Remote control Fan/Light using long range IR sensor
- Temperature controlled laptop fan using Thermistor
- Temperature measurement using LM 35
- Temperature measurement using Thermocouple
- Distance sensor using Ultrasonic sensor
- Sound level measurement using Mic with amplifier
- Magnetic field detector using Hall sensor
- Door security system using Reed switch