

# Maharaja Ranjit Singh Punjab Technical University, Bathinda

## Purchase of Equipment for BEEE Lab for PIT Rajpura & PIT GTB Garh Moga

Sr. No.	Description of Item	Qnt.	Unit
1	<p><b>To verify Ohm's Law and its limitations:</b>                      A Complete Experimental Kit Comprises of:</p> <p>a) Inbuilt variable regulated DC power supply Input <math>230 \pm 10\%</math> 50 Hz freq Range of DC supply (0-12) V                      b) Two analog meters to measure voltage &amp; current 100 mA, Voltmeter - 0-20 V                      c) Variable potentiometer of known value acting as load resistance                      d) Main On-Off switch, fuse &amp; Indication Light                      e) User manual and all other required accessories</p>	4	kits
2	<p><b>To verify Kirchoff's Laws:</b>                      Complete Kit With</p> <p>a) Variable power supply Input <math>230 V \pm 10\%</math> 50 Hz, Range of DC supply 0-10 V,                      b) Voltmeter &amp; ammeter to record Voltage &amp; Current                      c) A network of resistance with suitable points brought out on terminals to connect with meters at different points to note that voltage &amp; current at various stages in the network                      d) Supplied with adequate number of connecting leads and user manual and all other required accessories</p>	4	kits
3	<p><b>To measure the resistance and inductance of a coil by ammeter voltmeter method.</b>                      A panel should have facility to perform experiment with:</p> <p>a) Inbuilt Transformer                      b) Inbuilt R,L,C Load                      c) Inbuilt measuring Meters                      d) Connections can be done externally                      e) User manual and all other required accessories</p>	4	kits
4 (i)	<p>a) To find voltage current relationship in a R-L series circuit and to determine the power factor of the circuit (Annexure A)                      b) To verify the voltage and current relations in star and delta connected systems(Annexure A)                      c) To measure power and power factor in a single-phase AC circuit.(Annexure A)</p> <p><b>Common Apparatus</b>  <b>Single Phase Resistive Load</b>                      5 KW per phase (Total Load 15 KW)</p>	4	No.s
(ii)	<p><b>Three Phase Resistive Load</b>                      5 KW, 239 V, 50 Hz, Load per step = 0.5 KW</p>	4	No.s
(iii)	<p><b>Inductive Load</b>                      5 Amp single phase in 5 steps</p>	4	No.s
(iv)	<p><b>Capacitive Load</b>                      200 micro farad Single phase in 20 steps</p>	4	No.s
(v)	<p><b>Single phase Auto Transformer</b>                      voltage range 0-270 V, 50 Hz</p>	4	No.s
(vi)	<p><b>Three phase Auto Transformer</b>                      Input Voltage: 440 V, Output Voltage : 495 V, 50 Hz</p>	4	No.s
(vii)	<p><b>Moving Iron Voltmeter AC/DC</b>                      0-75/150 V</p>	10	No.s
(viii)	<p><b>Moving Iron Voltmeter AC/DC</b>                      0-250 V</p>	10	No.s
(ix)	<p><b>Moving Coil Voltmeter</b>                      0-300V</p>	4	No.s
(x)	<p><b>Moving Coil Ammeter</b>                      0-5A</p>	4	No.s
(xi)	<p><b>Moving Coil Wattmeter</b>                      0-1Kv</p>	4	No.s
(xii)	<p><b>Voltmeter AC/DC</b>                      0-250/500V</p>	10	No.s

(xiii)	<b>Ammeter AC/DC</b> 0.-100mA	8	No.s
(xiv)	<b>Ammeter AC/DC</b> 0-500mA	8	No.s
(xv)	<b>Ammeter AC/DC</b> 0-1A	8	No.s
(xvi)	<b>Ammeter AC/DC</b> 0-2.5	10	No.s
(xvii)	<b>Ammeter AC/DC</b> 0-5A	10	No.s
(xviii)	<b>Ammeter AC/DC</b> 0-10A	10	No.s
(xix)	<b>Ammeter AC/DC</b> 0.-20A	10	No.s
(xx)	<b>AC Wattmeter Dynamometer</b> 0-500 W	4	No.s
(xxi)	<b>Wattmeter</b> 0-2000W	4	No.s
(xxii)	<b>Digital Power Factor meter</b> Current 1A or 5A & voltage upto 600V with internal resistance.	4	No.s
(xxiii)	<b>Digital Multimeter</b> Technical Specifications: a) DC millivolts 600.0 mV-0.1 mV Accuracy 0.5 % + 2 b) DC volts, 6.000 V-0.001 V, 60.00 V- 0.01 V, 600.0 V-0.1 V Accuracy 0.5 % + 2 c) Auto volts, 600.0 V-0.1 V, Accuracy 2.0 % + 3 (dc, 45 Hz to 500 Hz) & 4.0 % + 3 (500 Hz to 1 kHz) d) AC millivolts, true-rms 600.0 mV-0.1 mV, 1.0 % + 3 (dc, 45 Hz to 500 Hz), 2.0 % + 3 (500 Hz to 1 kHz) e) AC volts, true-rms, 6.000 V- 0.001 V, 60.00 V-0.01 V, 600.0 V-0.1 V Accuracy 1.0 % + 3 (45 Hz to 500 Hz) & 2.0 % + 3 (500 Hz to 1 kHz) f) Ohms, 600.0 Ω-0.1 Ω, Accuracy 0.9 % + 2, 6.000 kΩ-0.001 kΩ Accuracy 0.9 % + 1, 60.00 kΩ-0.01 kΩ, 600.0 kΩ-0.1 kΩ, 6.000 MΩ-0.001 MΩ, 40.00 MΩ-0.01 MΩ Accuracy 5 % + 2 g) Capacitance, 1000 nF-1 nF Accuracy 1.9 % + 2, 10.00 μF-0.01 μF, 100.0 μF-0.1 μF, 9999 μF-1 μF, 100 μF to 1000 μF Accuracy 1.9 % + 2, > 1000 μF Accuracy 5 % + 20 h) AC amps true-rms, (45 Hz to 500 Hz), 6.000 A-0.001 A Accuracy 1.5 % + 3, 10.00 A-0.01 A i) DC amps, 6.000 A-0.001 A Accuracy 1.0 % + 3, 10.00 A-0.01 A	2	No.s
(xxvi)	<b>Digital Storage Oscilloscope</b> a) 60 MHz Dual Channel Digital Oscilloscope Band Width: 60 MHz on each channel, (b) Channels: 2 channels, (c) Sample Rate: 1 Giga Sampling Rate on each Channel, (d) Vertical Accuracy: ±3 % , (e) Zoom: Horizontal & Vertical expand or compress of waveform, (f) Maximum Input Voltage : ±300 V rms, (g) CAT II Input Coupling: AC, DC & GND (h) Time Base Range: 5 ns/div to 50 s/div, (i) Time base Accuracy : 50 ppm, (j) Trigger Source: CH1, CH2, EXT, Ext/5 & AC line Trigger, (k) View: To display trigger signal (l) Cursors Types: Voltage, Time, (m) FFT: FFT with 2048, (n) Sample points Limit Testing: For quick Pass/Fail comparison of any trigger input signal to user defined template, (o) Data Logging: Instrument should have Data Waveforms to a USB memory device for up to 24 hours, (p) Help Function: The context-sensitive help system provides important information specific to the task you are working on, (q) Autoset Menu: Single Bottom, automatic setup of all channels for vertical, Horizontal and trigger system, with undo autoset, (r) Autorange Menu: Automatically adjust vertical / horizontal oscilloscope settings when probe is moved from point to point , (s) Display: QVGA, Active Color TFT with adjustable multi-level contrast, (t) Variable Persistence: OFF 1 sec, 2 sec, 5 sec, infinite, (u) Format: YT and XY, (v) Ports: USB Host Port on Front Panel for USB drive , USB Device Port on Back side for connection with PC, (w) Temperature: Operating 0 to 50° C; Non-operating -40 to + 70°C, (x) Self Calibration: Instrument should have self Calibration with internally Generated Voltage, (y) Standard Probes: 2 Nos (60 MHz Passive Probe), (z) Warranty: At least Give Years (Warranty should be from OEM/mentioned on OEM datasheet	2	No.s

5	<p>To verify series and parallel resonance in AC circuits</p> <p>A Complete Experimental Kit Comprises of</p> <ol style="list-style-type: none"> <li>1. On board Signal generator (1-60 KHz)</li> <li>2 Generator Output 8 V PP</li> <li>3 On board LCD based Voltmeter &amp; frequency Counter</li> <li>4 Voltmeter: 2 V</li> <li>5 Main Supply 90-275 V, 50 Hz</li> <li>6 Multiple combination of components R, L, C should be provided</li> <li>7 Oscilloscope or LCD Display for voltage and frequency counter should be provided on board for observation</li> </ol>	2	Kit
6	<p><b>To Observe the B-H loop of ferromagnetic Core:</b> Material on CRO Inbuilt Fixed AC power supply output Voltage 3V AC-15V AC (Steps of 3 Volts) High Quality Aluminum used as front panel of 270 mm × 170 mm &amp; mounted on Light weight shock proof plastic cabinet symbol diagram printed on aluminum front Panel &amp; all important test points are brought out on front panel. Power requirement 230 V AC ±10 % 50 Hz Power Chord, Patch Cords % instructional Manual.</p>	2	kit
7	<p><b>To use a bridge rectifier for full- wave rectification of AC supply and to determine the relationship between RMS and average values of the rectified voltage.</b></p> <p>Trainer kit should consists of the following built-in parts:</p> <ol style="list-style-type: none"> <li>1. Half wave, full wave centre tap and full wave bridge rectifiers.</li> <li>2 Inbuilt Moving Iron Voltmeter 0-50 V AC/DC.</li> <li>3 Inbuilt Moving Coil Voltmeter 0-50 V DC.</li> <li>4 Inbuilt Ammeters 0-100mA</li> <li>5 Transformers having different tapping of different voltages.</li> <li>6 Different resistances as a load (10Ω to 100Ω)</li> <li>7 Inbuilt variable power supply 0-20 volts and fixed power supply 12-0-12 volts</li> <li>8 Circuit diagram for half wave, full wave centre tap and full wave bridge rectifier is printed on the front panel.</li> <li>9 User manual</li> </ol>	4	kits
8	<p><b>To measure the minimum operating voltage, current drawn, power consumed, and the power factor of a fluorescent tube light :</b> Fluorescent Tube of any Rating &amp; Apparatus Required</p>	4	kits
09 (a)	<p><b>To verify the working of a). Thermocouple b). Strain Gauge c). LVDT.</b></p> <p><b>THERMOCOUPLE TRAINER KIT Comprises of :</b></p> <ul style="list-style-type: none"> <li>• Thermocouple : J or K</li> <li>• Circuit : in built cold temperature junction compensation</li> <li>• Amplifier : Differential with feedback</li> <li>• Thermometer : Glass (110°) for reference</li> <li>• Test points: Sockets at different places for signals.</li> <li>• Potentiometer : Two (ambient &amp; span adjust)</li> <li>• Display : 3.5 digit digital</li> <li>• Power supply : Short circuit &amp; overload Protected</li> <li>• Mains : 230V</li> </ul> <p>User manual and all other required accessories</p>	4	kits
(b)	<p><b>LVDT TRAINER KIT Comprises of :</b></p> <p>AC-AC spring loaded 20mm LVDT with test points PIC microcontroller based system, easy to operate LCD 16x2 display unit to show LVDT output results 5KHz frequency generator with test points to adjust frequency test points for test LVDT calibration using Multimeter, on board power jack with power indicator, 5V operated test points to test output of LVDT, onboard power reset switch with LED indicator, buzzer indicator for finding LVDT null points, operational amplifier and signal conditioning circuit with test points, programming header to program and develop customized solution, light weight and tough plastic cabinet for easy handling system come with operating user Manual, connecting cables, power supply and all other required accessories</p>	4	kits

(c)	<b>STRAIN GAUGES TRAINER KIT</b> Comprises of : c) Rectangular Foil type strain gauge sensor 350Ω bonded on a flexible metal strip and connected in Wheat stone bridge configuration, on board power supply of +5V DC, on board instrumentation amplifier Ad620 section, 16x2 LCD display for displacement reading, microcontroller 8051 on board for processing, test point for Strain Gauge and amplifier, output with easy to plug banana connectors, fixed in wooden box and User manual and all other required accessories	4	kits
10	<b>To verify the rating of compact fluorescent lamp (CFL):</b> CFL of any rating & Apparatus Required	8	No.
11	To obtain the characteristics of a P-N junction diode (TO PLOT FORWARD AND REVERSE CHARACTERISTICS OF A PN JUNCTION DIODE). Instrument/Trainer kit should consist of: <ul style="list-style-type: none"> <li>• DC regulated Power Supply (0-30V) with coarse and fine control potentiometer</li> <li>• Two PN junction diodes mounted on the behind of front panel with connection in sockets.</li> <li>• Test points should be provided on board.</li> <li>• Inbuilt ammeter and voltmeter should be provided (or High quality window type/dual range moving coil analog square meters): A Range: 1μA to 200mA, 3½ digit LCD V Range: 1mV to 200V, 3½ digit LCD</li> <li>• Mains: 230V AC ±10% Detachable mains chords to be provided: High quality computer power cord and patch cords</li> <li>• High quality aluminium panel should be used for long durability</li> <li>• Trainer should be on Legend PCB. Housed in a Molded case with cover</li> </ul> Accessories included: Operating E manual, Patch cords 2mm socketable with gold plated contacts, Mains chord, user manual and all other required accessories	4	kits
12	To verify the truth table of logic gates.(NOT, AND, OR, NAND, NOR, XOR and XNOR) <ul style="list-style-type: none"> <li>• Input: +5V DC/500mA</li> <li>• Logic levels: +5V HIGH (Logic 1) and 0V LOW (Logic 0)</li> <li>• LEDs for visual indication of input and outputs</li> <li>• SPDT switches for input logic section</li> <li>• Interconnections: 2mm banana socket with 2mm stackable patch cords</li> <li>• Mains Power Supply: 5V DC Adopter</li> <li>• Complete functional diagram of each Gate</li> <li>• Provision to verify truth table with the realisation of Demorgan's theorms and Boolean expressions.</li> <li>• Complete functional diagram of each gate should be screen printed nicely</li> <li>• User manual for performing various experiments and all other required accessories (such as 7400,7402,7404,7408, 7432. 7486, 74266)</li> </ul>	4	kits
13 (i)	To connect the following ,measuring instruments to measure current, voltage and power in AC/DC circuits: i) Moving Coil Instruments, ii) Moving Iron Instruments, iii) Dynamometer Instruments and iv) Multimeter-both Digital and Analog Type Various Apparatus Required (Annexure-A) <b>Common Apparatus</b> <b>Single Phase Resistive Load</b> 5 KW per phase (Total Load 15 KW)	4	No.s
(ii)	<b>Three Phase Resistive Load</b> 5 KW, 239 V, 50 Hz, Load per step = 0.5 KW	4	No.s
(iii)	<b>Inductive Load</b> 5 Amp single phase in 5 steps	4	No.s
(iv)	<b>Capacitive Load</b> 200 micro farad Single phase in 20 steps	4	No.s
(v)	<b>Single phase Auto Transformer</b> voltage range 0-270 V, 50 Hz	4	No.s
(vi)	<b>Three phase Auto Transformer</b> Input Voltage: 440 V, Output Voltage : 495 V, 50 Hz	4	No.s

(vii)	<b>Moving Iron Voltmeter AC/DC</b> 0-75/150 V	10	No.s
(viii)	<b>Moving Iron Voltmeter AC/DC</b> 0-250 V	10	No.s
(ix)	<b>Moving Coil Voltmeter</b> 0-300V	4	No.s
(x)	<b>Moving Coil Ammeter</b> 0-5A	4	No.s
(xi)	<b>Moving Coil Wattmeter</b> 0-1Kv	4	No.s
(xii)	<b>Voltmeter AC/DC</b> 0-250/500V	10	No.s
(xiii)	<b>Ammeter AC/DC</b> 0.-100mA	8	No.s
(xiv)	<b>Ammeter AC/DC</b> 0-500mA	8	No.s
(xv)	<b>Ammeter AC/DC</b> 0-1A	8	No.s
(xvi)	<b>Ammeter AC/DC</b> 0-2.5	10	No.s
(xvii)	<b>Ammeter AC/DC</b> 0-5A	10	No.s
(xviii)	<b>Ammeter AC/DC</b> 0-10A	10	No.s
(xix)	<b>Ammeter AC/DC</b> 0.-20A	10	No.s
(xx)	<b>AC Wattmeter Dynamometer</b> 0-500 W	4	No.s
(xxi)	<b>Wattmeter</b> 0-2000W	4	No.s
(xxii)	<b>Digital Power Factor meter</b> Current 1A or 5A & voltage upto 600V with internal resistance.	4	No.s
(xxiii)	<b>Digital Multimeter</b> Technical Specifications: a) DC millivolts 600.0 mV-0.1 mV Accuracy 0.5 % + 2 b) DC volts, 6.000 V-0.001 V, 60.00 V- 0.01 V, 600.0 V-0.1 V Accuracy 0.5 % + 2 c) Auto volts, 600.0 V-0.1 V, Accuracy 2.0 % + 3 (dc, 45 Hz to 500 Hz) & 4.0 % + 3 (500 Hz to 1 kHz) d) AC millivolts, true-rms 600.0 mV-0.1 mV, 1.0 % + 3 (dc, 45 Hz to 500 Hz), 2.0 % + 3 (500 Hz to 1 kHz) e) AC volts, true-rms, 6.000 V- 0.001 V, 60.00 V-0.01 V, 600.0 V-0.1 V Accuracy 1.0 % + 3 (45 Hz to 500 Hz) & 2.0 % + 3 (500 Hz to 1 kHz) f) Ohms, 600.0 Ω-0.1 Ω, Accuracy 0.9 % + 2, 6.000 kΩ-0.001 kΩ Accuracy 0.9 % + 1, 60.00 kΩ-0.01 kΩ, 600.0 kΩ-0.1 kΩ, 6.000 MΩ-0.001 MΩ, 40.00 MΩ-0.01 MΩ Accuracy 5 % + 2 g) Capacitance, 1000 nF-1 nF Accuracy 1.9 % + 2, 10.00 μF-0.01 μF, 100.0 μF-0.1 μF, 9999 μF-1 μF, 100 μF to 1000 μF Accuracy 1.9 % + 2, > 1000 μF Accuracy 5 % + 20 h) AC amps true-rms, (45 Hz to 500 Hz), 6.000 A-0.001 A Accuracy 1.5 % + 3, 10.00 A-0.01 A i) DC amps, 6.000 A-0.001 A Accuracy 1.0 % + 3, 10.00 A-0.01 A	2	No.s

14	<p><b>Emitter (CE) configuration</b></p> <p>The board consists of the following built in parts:</p> <p>(i) Two 0-10V D.C. at 50mA, continuously variable Power Supplies for Base Emitter &amp; Collector Emitter junctions</p> <p>(ii) Two D.C. Ammeters, 65mm rectangular dial with switch selectable ranges of 200mA &amp; 10mA</p> <p>(iii) Two D.C. Voltmeter, 65mm rectangular dial with switch selectable ranges of 1V and 10V</p> <p>(iv) Two Silicon (NPN &amp; PNP) transistors and two Germanium (NPN &amp; PNP) transistors</p> <p>(v) Adequate no. of other electronic components:</p> <p>Mains ON/OFF switch.</p> <p>Transistor BC107-1No. Regulated power Supply (0-30V) -1No.</p> <p>Function Generator -1No.</p> <p>CRO -1No.</p> <p>Resistors [33K<math>\Omega</math>, 3.3K<math>\Omega</math>, 330<math>\Omega</math>, -1No.Each 1.5K<math>\Omega</math>, 1K<math>\Omega</math>, 2.2K<math>\Omega</math>, 4.7K<math>\Omega</math>]</p> <p>Capacitors, 10<math>\mu</math>F -2No 100<math>\mu</math>F -1No.</p> <p>Bread Board Connecting Wires, User manual and all other required accessories</p>	4	kit
15	<p><b>To perform open-and short circuit tests on a single phase transformer and calculate its efficiency</b></p> <p>The trainer should have:</p> <ul style="list-style-type: none"> <li>● Main Supply Single Phase, 230 V <math>\pm</math> 10 %, 50 Hz</li> <li>● Inbuilt transformer: 1 KVA, Rated Current :5A</li> <li>● Primary Voltage: 0-125 V; Secondary Voltage:, 0-125 V</li> <li>● Inbuilt Autotransformer: 270V/5A; MCB: 5A</li> <li>● Two Voltmeter MI: 0-300 V &amp; one Voltmeter 0-50 V</li> <li>● Two Ammeter MI 5A &amp; one Ammeter 1Amp</li> <li>● One Wattmeter : 100 W &amp; 1000 W</li> <li>● Resistive Load 1.2 KW each step of 100 W</li> </ul>	2	No.
16	<p><b>To start and reverse the direction of rotation of a</b></p> <p><b>i. DC motor</b></p> <p><b>ii. Induction motor</b></p> <p>(i) Three Phase Induction Motor :3 HP, fitted with necessary accessories and starter</p> <p>(ii) DC Shunt Wound self excited, with DC Starter: 1 HP, 1500 RPM, 230 V with required accessories.</p> <p>(iii) 0-300V DC source required for DC motor</p>	2	No.
		2	No.

**Note:- 50% of each item should be delivered at PIT Rajpura and PIT GTB Garh (Moga)**