Analog Electronics Lab

S.No	Specification	Qty
01.	**Function Generator** : Function: Sine, Square, Triangle ,Ramp ,Pulse ,TTL & DC Freq. Range :0.3 Hz to10 MHz Sine , 0.3 Hz to 3 MHz Square & Triangle ; 0.3 to 2 MHz (Ramp ,Pulse & TTL) In seven steps, Variable control between steps. Pulse duty cycle : 15 % to 85 % var. (min width 200 ns) Frequency Range and Mode Selection : Microcontroller based Frequency Display : 20 X 4Alpha numeric LCD with backlit Output Voltage : 20 Vpp open circuit , Attenuation :20 & 40 dB (fixed) , 20 dB variable attenuation Offset Range : ± 5 V DC adjustable , External Frequency counter: up to 40 MHz Modulation: FM, Mod. Frequency: DC-20 KHz, 2 Vpp max. Mains Supply : 230 V ±10 %, 50 Hz Instrument should have user friendly operation with selections of parameters like Range ,function, attenuation switch selectable just below the LCD display where these functions are displayed. Accessories: BNC to BNC Cable with gold plated connectors.	10
02.	**3 ¾ digit (4000 counts) Digital Multimeter embedded rubber Holster auto range** DC voltage range : 400 mv to 1000volts. AC voltage range : 4 V to 750volts. DC Current range : 400 μA to 10 A. AC Current range : 400 μA to 10 A. Resistance range : 400 Ω to 40 M Ω Capacitance range : 40nF to 100μF Frequency range : 10 Hz to 10 MHz Duty Cycle : 01. to 99 %. Display : LCD 63X31mm Battery : 9V Accessories : Test leads, Test clips & manuals. Other Functions : Diode test, continuity ,relative measurement, Datahold, Backlit LCD, sleep mode, low batt. Indicator.	10
03.	**PN Diode ,Zener Diode & LED Characteristics Trainer.** Trainer should be compact & can be used to study study the PN, Zener & LED diode Forward and reverse characteristics Technical Specifications PN , Zener diode and LED should be provided on board. On Board DC power supply : +12V DC Ammeter : 3 1/2 Digit LCD ; Range : 1μA to 200mA Voltmeter : 3 1/2 Digit LCD ; Range : 1mV to 200V Mains Supply : 230V AC ±10% (Detachable mains chord to be provided) Trainer should be on Legend PCB .Housed in a Molded case with moulded cover on top ;Should have in built power supply. Circuit diagram should be printed on the top of the board. Test points provided on board to measure voltage, current & resistance at various points.	05
04.	**Transistor Characteristics Trainer** Trainer should be compact & can be used to study Characteristics of PNP, NPN transistor in all different Type of configuration and to understand various Regions of operation of PNP and NPN Transistor. CE,CB& CC config. Technical Specifications: DC power supply : +5V, -5V+12V, -12V Transistor : BC548, 2N3906 ; Base should be provided to use other transistors . Ammeter : 3½ digit LCD ; Range : 1μA to 200mA Voltmeter : 3½ digit LCD ; Range :1mV to 200V	05

	Mains : 230 V AC ±10% (Detachable mains chord to be provided) Trainer should be on Legend PCB .Housed in a Molded case with moulded cover on top ;Should have in built power supply. Circuit diagram should be printed on the top of the board. Test points provided on board to measure voltage, current & resistance at various points.	
05.	**FET Characteristics Trainer** Trainer should be compact & can be used to Study of characteristics of Field Effect Transistor and to evaluate-AC Drain resistance, Transconductance, Amplification factor, and DC Drain resistance Technical Specifications: DC power supply : -5V+12V, FET :J112A Ammeter : 3½ digit LCD ; Range : 2mA to 200mA Voltmeter : 3½ digit LCD ; Range :200mV to 200V Mains : 230 V AC ±10% (Detachable mains chord to be provided) Trainer should be on Legend PCB .Housed in a Molded case with moulded cover on top ;Should have in built power supply. Circuit diagram should be printed on the top of the board. Test points provided on board to measure voltage, current & resistance at various points.	05
06.	**Half wave ,Full wave & Bridge rectifier** Study of Half wave, Full wave & Bridge Rectifier. Test points are provided on board. Transformer Rating: 9 V center tapped (300mA) approx. Mains Supply : 230V, ±10%, 50Hz Half wave Rectifier output : + 4V DC approx. Center-Trapped Rectifier : +8 V DC approx. Bridge Rectifier Output : + 8 V DC approx. Filter : LC Type ;Load : Resistive 220W, ½Watt Interconnections: 2mm ;Patch cords : 2 mm banana stackable Mains : 230V AC ±10% (Detachable mains chord to be provided) Trainer should be on Legend PCB .Housed in a Moulded case with moulded cover.	05
07.	**Zener diode as Voltage regulator** Trainer should have facility to study the operation of Zener diode as a voltage regulator with the variation in source voltage and load resistance. This training board should be provided with different sections of a regulated power supply i.e. step-down transformer, bridge rectifier, capacitive filter and voltage regulator. Technical Specifications : Transformer : 0 - 9 V, 500 mA (approx.) Filter : Capacitive ; 1000 µF, 35 V Zener Diode : V z = 5.6 V ; I ZM = 178 mA Potentiometer, P1 : 4.7 KΩ ; P2 : 4.7 KΩ Mains Supply : 230 V ±10%, 50 Hz Interconnections: 2mm ;Patch cords : 2 mm banana stackable Mains : 230 V AC ±10% (Detachable mains chord to be provided) Trainer should be on Legend PCB with no components on the top of board. Housed in a Moulded case with moulded cover on top	05
08.	**Two RC Coupled amplifier and emitter follower** Trainer should have : Provision to study Single & Multistage RC Coupled amplifier & Emitter follower circuit. On Board sine wave generator with variable frequency and amplitude & DC power supply Technical specifications: On Board DC power supply : +12 V, +5 V On Board Sine wave generator Frequency : 10 Hz - 100 KHz ±10% ; Amplitude : 0 to 5 Vpp Interconnections: 2mm ;Patch cords : 2 mm banana stackable Mains : 230 V AC ±10% (Detachable mains chord to be provided) Fuse : 500 mA, (slow blow, spare fuse is given in mains socket)	05

	Trainer should be on Legend PCB with no components on the top of board. Housed in a Moulded case with moulded cover on top	

09.	**OP Amp characteristics & Application trainer** Trainer should be compact & should have different blocks to study: Open-Loop Gain as a function of frequency ,study and measure CMRR , Op-amp gain in voltage series & Shunt feedback configuration ; Voltage follower i.e. buffer ,Differential amplifier and observe its output at noisy signal common to both input terminal ; Op-amp as I-V converter & V-I Converter Op-amp as inverting Summer ,inverting Averager, inverting Scaler ; Op-amp as a non-inverting Averager , non-inverting Summer; Op-amp as an Integrator , Differentiator Specifications Function Generator ::Output : Sine, Square and Triangle Frequency : 10 Hz 100 KHz DC Power Supplies: 0 - 5 V variable, 2 Nos. Test Points : 28 Power Consumption : 4 VA (approx.) Interconnections: 2mm ;Patch cords : 2 mm banana stackable Mains : 230V AC ±10% (Detachable mains chord to be provided) Trainer should be on Legend PCB .Housed in a Moulded case with no components on the top of the board.	05
10.	**Wein Bridge Oscillators Trainer** Trainer should have : Provision to Study the working principle of Wein Bridge Oscillators and their use in generation of sinusoidal waveform. On board resistances & potentiometer. Biasing Voltage : +12V DC Design of Oscillators : Passive Elements with Op - Amp Mains : 230 V ±10%, 50 Hz (Detachable mains chord) Interconnections: 2mm gold plated Patch cords : 2 mm banana stackable & gold plated Mains : 230 V AC ±10% (Detachable mains chord to be provided) Trainer should be on Legend PCB with no components on the top of board. Housed in a Moulded case with moulded cover on top	05
11.	**Hartley and Colpitt Oscillators Trainer** Trainer should have : Provision to Study the working principle of Hartley and Colpitt Oscillators and their use in generation of sinusoidal waveform. Option to choose different sets of Capacitors & Inductors. Biasing Voltage : +12V DC Design of Oscillators : Passive Elements with NPN Transistors Mains : 230 V ±10%, 50 Hz (Detachable mains chord) Interconnections: 2mm gold plated Patch cords : 2 mm banana stackable & gold plated Mains : 230 V AC ±10% (Detachable mains chord to be provided) Trainer should be on Legend PCB with no components on the top of board. Housed in a Moulded case with moulded cover on top	05

12.	**Oscilloscope demonstrator**	05
	Oscilloscope in open form with all components and controls placed on single PCB .Amplifier, Time base, Channel section signal available on test points. Separate sections for PS, EHT, VA, HA, TB & Trigger for easy identification. Fault creation & Rectification provided .Track printing with different colours on different sections on component board for easy circuit training Legend Printing on PCB for easy identification of components Can be used as a standard 20 MHz Dual Trace Oscilloscope Bandwidth : DC-20 MHz (-3 dB) Channel I, Channel II, Channel I & II Alternate or chopped, Controls provided on PCB. Channel selection signals available at Test points. X-Y operation 1:1 **Vertical Deflection (Y)** Deflection Coefficients : 12 calibrated steps 5 mV /div - 20 Maximum Input voltage : 350 V (DC + Peak AC) Pre-Amp, Final Amp Outputs at Test Points. **Time base** Time Coefficients : 18 calibrated steps, 0.5 μs / cm - 0.2 s / cm with magnifier x 5 to 100 ns /cm.TB generation at Test Points **Trigger System:** Modes : Automatic or Variable ;Source : CH I, CH II, External Slope : Positive or Negative ;Coupling : AC, TV Frame **Component Tester :** Test Voltage : Max 8.6 V (Open) rms ;Test Current : Max 8 mA (Shorted) rms ;Test Frequency : 50 Hz, Test circuit grounded to chassis Fault Simulation : Total 15 Faults included Included Accessories: Learning material (CD)., BNC-BNC Cable 1 No., BNC - Prod tip Cable 1 No., Test Prods 1 pair,. Additional Jumpers 10	