

Item	Description		Units
Antenna Trainer System	<b>Antenna Trainer System should have features which enable the following tests and experiments:</b>		1
	Polar plots and polarization		
	Wave modulation and demodulation		
	Antenna gain		
	Antenna beam width		
	Element current study		
	Front-back ratio study		
	Antenna matching		
	<ul style="list-style-type: none"> <li>Antenna radiation with distance.</li> </ul>		
		<b>Technical Specification</b>	<b>Base Unit</b>
	RF generator	750MHz (output adjustable)	
	RF Input		
	Tone Generator	1KHz (output adjustable)	
	Directional Coupler	Forward and reverse (selectable)	
	Matching Stub	Slider type	
	Antenna Rotation	0-360 degrees. Resolution 1 degree	
	Receiving Antenna	Folded dipole with reflector	
	Detector Display	Level adjustable meter	
	Detector		
	Power Supply	230V $\pm$ 10% 50Hz	
	Interconnections	4mm sockets	
	<i>The Trainer Model should consist of:</i>		
	Dipole $\lambda/2$		
	Folded Dipole $\lambda/2$		
	Dipole $\lambda/4$		
	Yagi UDA Folded Dipole (3E)		
	Yagi UDA Folded Dipole (5E)		
	Yagi UDA Dipole (5E)		

Item	Description		Units
	Yagi UDA Dipole (7E)		
	Horizontal End Fed Hertz Antenna		
	Horizontal End Fed Zeppelin Antenna		
	Ground Plane with Reflector and Director		
	Slot Antenna $\lambda/2$		
	Loop Antenna		
	Helix Antenna		
	$\lambda/2$ Phase Array		
	$\lambda/4$ Phase Array		
	Combined Collinear Array		
	Log Periodic Antenna		
	Rhombus Antenna		
	Cut Paraboloid Reflector Antenna		
	Current Probe		
	Mounting Stands		
	BNC Tee		
	BNC-BNC Adapter Male.		
	BNC-BNC Adapter Female.		
	BNC-BNC Cables		
	Screwdriver		
	Polar Graphs		
	Antenna Fabrication Kit		
	Power Cord		
	Accessories Case		
	5 Pin DIN cable		
	Patch Cords,		
	RS 232 Cable		
	Operating Manual		
	Student Workbook		
<b>Microwave Trainer System</b>			1
	Microwave Trainer System should have features which enable the following tests and experiments:		

Item	Description		Units
	Tests & Experiments Suggested:		
	Study of Characteristics of Reflex Klystron		
	Frequency Guide & Free Space Wavelength Measurement		
	Study of E-Plane, H-Plane, Magic Tees, Bend		
	Study of Fixed/Variable Attenuator		
	Study of Isolator's/ Circulators		
	Study of Directional Couplers		
	Radiation Pattern & Gain Characteristics of Antennas		
	To Measure the SWR and Reflection Coefficient		
	Dielectric Measurement of Solids/Liquids		
	Study of the Doppler Effect		
	Impedence Measurement		
	Phase Shift Measurement		
	Measurement of Q of Cavity		
	<b>Technical Specification</b>		
	<b>Klystron Power Supply</b>		
	Klystron Power Supply, is a state of the art solid state, regulated power supply for operating low power Klystrons.		
	<b>It has the following features:</b>		
	Regulated Beam Supply and Repeller Supply Voltage		
	Overload TRIP protection and Beam Supply output		
	LED Digital metering for Beam Voltage, Current and Repeller voltage		
	Stand by mode		
	Modular construction for easy maintenance.		

Item	Description		Units
	In addition to AM and FM modulation of Beam current, a provision for externally modulating the Klystron supply and desired signal waveform has been provided.		
	<b>Specification</b>		
	<b>Input Voltage</b>	230VAC $\pm$ 10% 50Hz	
	<b>Beam Supply</b>	Voltage 240 – 420 VDC	
		Variable Current 50mA	
		Regulation 0.5% for 10% I/P variation	
		Ripple <5mV RMS	
	<b>Repeller Supply</b>	10 – 270 VDC variable	
		Regulation 0.25% for 10% I/P variation	
	<b>Filament Supply</b>	6.3 VDC	
	<b>Over-load Trip Current</b>	65mA	
	<b>Modulation</b>	AM (Square)	
	<b>Frequency Range</b>	500 – 2500 Hz	
	<b>Amplitude</b>	0 – 110V	
	<b>External</b>	Through External Modulating Signal	
	<b>Display</b>	Digital display for (a) Beam Voltage	
		(b) Beam Current (c) Repeller Voltage	
	<b>Standby Mode</b>	8-pin Octal Socket	
	<b>Connectors</b>	BNC for External Modulation	
	<i>The Trainer Model should consist of:</i>		
	Solid State Klystron Power Supply		
	Klystron Mount		
	Klystron tube 2K25 / 2K27		
	Isolator		
	Frequency Meter (Direct Readout)		
	Variable Attenuator		
	Slotted Section		
	Tuneable Probe		
	Detector Mount		
	Movable Short		
	Matched Termination		
	VSWR Meter		
	Wave Guide Stand		
	S. S. Tuner		
	Waveguide bend, 90o		
	Precision Movable Short		
	Waveguide Twist		
	Waveguide cavity		

Item	Description		Units
	Fixed Attenuator: 3, 6, 10 dB		
	Variable Attenuator : 20dB		
	Slide Screw Tuner		
	E-Plane Tee		
	H-Plane Tee		
	Magic Tee		
	Multi-hole Directional Coupler, 3,10 dB		
	C. D. Coupler 20dB		
	Three Port Circulator (T/Y)		
	E-Plane Bend, H-Plane bend		
	Standard Gain Horn		
	Pick up horn		
	Slotted Broad Wall		
	Slotted Narrow Wall		
	Dielectric Antenna		
	E-Plane Sectoral Horn		
	H-Plane Sectoral Horn		
	Pyramidal Horn		
	Parabolic Dish		
	Solid Dielectric Cell		
	Liquid Dielectric Cell		
	Phase Shifter		
	Solid Dielectric of Teflon Shifter		
	Nylon, Ebonite, Perspex & wax in 10, 20, 30mm lengths		
	Cooling Fan		
	BNC to BNC Cable		
	Coaxial-W/G Adaptor		
	Coaxial Cable N to N		
<b>Fiber Optic Trainer</b>			1
	<b>Transmitter Module</b>		
	<i>1. Transmitted Light Wavelength: 660 nm and 820 nm</i>		
	<i>2. Data Rate: 1 Mbps</i>		
	<i>3. Transmitter Bandwidth: 1 MHz</i>		
	<i>4. Includes digital and analog transmitters and also covers with E/O conversion circuits</i>		

Item	Description		Units
	5. Built-in microphone input terminal and audio amplifier		
	6. Built-in sine wave output signal, and also includes tunable amplitude and frequency outputs.		
	Amplitude: 2 Vpp; Frequency: 100 H z ~ 2.5 kHz		
	7. Built-in digital data generator, used to produce TTL signal and CMOS level output		
	8. The wavelength of fiber optic transmission line: 500 nm ~ 1200 nm; ST and DIN connectors.		
	<b>Receiver Module</b>		
	1. Receiver Light Wavelength: 660 nm and 820 nm		
	2. Data Rate: 1 Mbps		
	3. Receiver Bandwidth: 1 MHz		
	4. Includes digital and analog receivers and also covers with E/O conversion circuits		
	5. Equipped with a tunable amplifier, which can drive the 8 ohm speaker amplifier		
	6. The wavelength of fiber optic transmission line: 500 nm ~ 1200 nm; ST and DIN connectors.		
	<b>FOC-10503: Computer Control Module</b>		
	1. Transmission interface: RS-232		

Item	Description		Units
	2. <i>Transmission Baud Rate: 9600 bps</i>		
	3. <i>Type of display: LCD 16x2 characters</i>		
	4. <i>Input interface: 4x4 keypad</i>		
	5. <i>Serial characters can be inputted from keypad</i>		
	6. <i>Data transmission operation software included</i>		
	7. <i>LED indicator</i>		
	<b>Analog and Digital Signal Modulation Module</b>		1
	1. <i>AM Modulation and Demodulation</i>		
	a. <i>AM Modulation:</i>		
	* <i>Carrier Signal: 540 kHz ~ 1600 kHz</i>		
	* <i>Audio Frequency Signal: 1 kHz ~ 2 kHz</i>		
	b. <i>AM Demodulation:</i>		
	* <i>Carrier Signal: 540 kHz ~ 1600 kHz</i>		
	* <i>Audio Frequency Signal: 1 kHz ~ 2 kHz</i>		
	* <i>Modulation Index: 50 %</i>		
	2. <i>FM Modulation and Demodulation</i>		
	a. <i>FM Modulation:</i>		
	* <i>Carrier Signal: 20 kHz</i>		
	* <i>Audio Frequency Signal: 1 kHz ~ 5 kHz</i>		
	b. <i>FM Demodulation:</i>		
	* <i>Nature Frequency: 20 kHz</i>		
	* <i>Audio Frequency Signal: 1 kHz ~ 3kHz</i>		

Item	Description		Units
	<b>3. ASK Modulation and Demodulation</b>		
	a. ASK Modulation:		
	* Carrier Signal: 20 kHz ~ 100 kHz		
	* Data Signal: 100 bps ~ 1 kbps		
	b. ASK Demodulation:		
	* Carrier Signal: 20 kHz ~ 100 kHz		
	* Data Signal: 100 bps ~ 1 kbps		
	<b>4. FSK Modulation and Demodulation</b>		
	a. FSK Modulation:		
	* Space Signal: 1370 Hz		
	* Mark Signal: 100 bps ~ 500 bps		
	b. FSK Demodulation:		
	* Space Signal: 1370 Hz		
	* Mark Signal: 870 Hz		
	* Data Signal: 100 bps ~ 500 bps		
	<b>Digital Signal Processing Module</b>		1
	<b>1. Signal Source Encoder and Decoder (CVSD)</b>		
	a. Sampling Frequency: 16 kHz ~ 50 kHz		
	b. Audio Frequency Signal: 100 Hz ~ 2 kHz		
	c. TTL input and output level signals		
	<b>2. Channel Encoder and Decoder (Manchester)</b>		



Item	Description	Units
	a. Input TTL level signal	
	b. CLK: 500 Hz ~ 1 kHz	
	c. Data Rate: 250 bps ~ 500 bps	
<b>Analog Communication Training System</b>	<b>The System should include:</b>	1
	Power supply	
	AM modulator	
	AM Demodulator	
	FM modulator	
	PLL, VCO and FM detector	
	Mixer and frequency converter	
	Band Pass filter and slope detector	
	Amplifiers with Microphone	
	Audio amplifiers	
	Volume potentiometer & speaker	
	Tuner RF amplifier and antenna	
	Resonator tuned amplifier with AGC circuit	
	RC oscillator	
	Crystal oscillator	
<b>Digital Communication Training System</b>	<b>The System should include:</b>	1
	Power supply	
	Data Transmitter	
	ASK modulator	
	FSK modulator	
	PSK modulator	
	DPSK modulator	
	QPSK modulator	
	ASK modulator	
	PLL, VCC AND FSK DETECTOR	
	PSK Demodulator	
	DPSK Demodulator	
	QPSK Demodulator	
	Band pass filter	
	Envelope detector	

Item	Description		Units
<b>Analog-Digital Signal Conversion Training System</b>	<b><i>The System should include:</i></b>		1
	Power supply		
	8 bit ADC		
	8 bit DAC		
	8 switches		
	8 LEDs		
	TDM multiplexer		
	TDM demultiplexer		
	Parallel to serial converter		
	Serial to parallel converter		
	Data encoder		
	Data decoder		
	Counter and pulse generator		
	Amplifiers and Microphone		
	Audio amplifiers and speaker		
Item	Description		Units
<b>Acquisition card</b>	multiple Digital I/O (minimum 10),		6
PCI-PD2-MF-16- 400/14L from <b>Super Logics</b>	multiple analog Input (minimum 4)		
	multiple analog Output (minimum 2)		
	Multi-platform support (Win98, WinXP, Win2000, Linux)		
	minimum sampling rate 200Ks/s		
	Counters, timers (minimum 2)		
	Software support for visual tools (e.g. Visual C++, Visual Basic, etc)		
	Software support for MATLAB, LabView		
	Terminal panel and terminal cable for panel-PC connection		
	minimum 12-bit A/D (minimum 1)		
	PCI-based board		

Item	Description		Units
<b>DAC Card from National Instruments</b>	NI USB-6009 general purpose 14 bit card		6
<b>PICmicro programmer</b>	Support for 28 and 40 pin PICmicro microcontrollers parallel-port based parallel-port cable for PC-programmer connection		7
	Windows-based software support for PICmicro programming		
	ZIF sockets for 28 and 40 pin PICmicro microcontrollers		
<b>Digital Oscilloscope</b>	150 - 200 MHZ bandwidth		8
	Monochrome LCD display		
<b>Digital Oscilloscope</b>	250 - 300 MHZ bandwidth		4
	Monochrome LCD display		
<b>Digital Multimeter</b>	AC/DC voltage, AC/DC current, resistance and diode tests		12
	AC/DC voltage, AC/DC current, resistance and diode tests		
	0 - 1000 voltage range, 0 - 20 current range		
	High resolution		
<b>Function Generator</b>	Frequency range: 1 HZ - 6 MHZ		12
	Waveforms: Sine, triangle, square, ramp		
	Dual display frequency and amplitude		
	Variable DC offset control		

Item	Description		Units
<b>DC Power Supply</b>	Triple output (30V / 3A) x2, (5V / 3A) x 1		12
	Overload and reverse polarity protection		
	Constnat Voltage and constant curent opration		
	Low ripple and noise		
<b><u>LAB-X1 Experimenter Boards</u></b>	16 switch keypad, 3 potentiometers, IR and temperature		6
	LED bargraph, 2x20 LCD module, PWM		
	Serial EEPROM: I2C, SPI, Microwire		
	40-pin ZIF socket for PICmicro MCU		
	Jumper selectable oscillator from 4MHZ to 20 MHZ		
	Prototyping area for additional circuits		
<b>DC motor with gearhead</b>	High torque, small size		10
	Voltage 12V, Current < 2A		
	gearhead output 200 RPM		
<b>Stepper motor</b>	2 or 4-phase stepper motor		10
	1.8 Degree / step		
	Light weight, small size, high torque		
<b>Distance measuring sensor</b>	Infra-red based		10
	measuring distance 10cm - 80cm		
	Light weight, high torque		
<b>Proximity switch</b>	metal detector		10
	measuring distance 1mm - 5mm		

Item	Description		Units
<b>DC motor driver</b>	Handles DC motors with current consumption $\leq 2A$		10
	small size, high reliability		
<b>Stepper motor driver</b>	Handles stepper motors with current consumption $\leq 1A$		10
	small size, high reliability		
<b>Limit switches</b>	Light weight, high reliability		20
<b>Temperature Sensor driver</b>	small size, high reliability, handles the LM35 temperature sensor		12
<b>Miscellaneous components</b>	Microcontrollers (50 – 16F84, 16F877, 18F452),		
	capacitors (1nF, 10nF, 0.1uF, 1uF, 10uF)		
	Oscillators (4MHZ, 20MHZ)		
	Resistors (220, 470, 1K, 4.7K, 10K, 100K, 1M)		
<b>Additional Hardware</b>	Programmable controllers for ethernet applications		1