

# ***Punjabi University, Patiala***

*(Established under Punjab Act # 35 of 1961)*

## ***Department of Electronics & Communication Engineering***

### **SHORT TERM E-TENDER NOTICE**

E-Tenders on project rate basis through electronic tendering process are invited from the Manufacturers/ Suppliers/ Dealers etc., for the Purchase of Kits under ECE Lab Equipment listed below, fulfilling the eligibility criteria mentioned herein that should be uploaded & received on <https://tenderwizard.com/PUNJAB>

1. Last date and Time for receipt of Tender online: Date: 15 May, 2018 (Tuesday) – 05:00 PM
2. Time and date of opening Technical bid: Date: 16 May, 2018 (Wednesday) – 11:00 AM
3. Time and date of opening Financial bid: Date: 17 May, 2018 (Thursday) – 03:00 PM

<i>Sr.No</i>	<i>Name of Supply</i>	<i>Earnest Money (Refundable)</i>	<i>Tender Fees (Non Refundable)</i>	<i>Bid processing fee.</i>
1.	Purchase of Lab Equipment: <b>Stand Alone Kits</b> to strengthen ECE Laboratories such as (A) Analog Electronics Lab, (B) Communication System Lab, (C) Wireless Communication Lab & (D) Optical Communication Lab for Department of ECE at Punjabi University Patiala.	17,000/-	2,000/-	2,360/-

Aspiring Tenderer who has not obtained the User ID and password for participating in e-tendering may obtain the same by registering in the e-procurement portal [www.tenderwizard.com/PUNJAB](http://www.tenderwizard.com/PUNJAB). The Tenderers once registered can participate in any of the department tenders.

For any clarification contact 9257209340, 0172-5035985, 8146699866 or E-mail : [etenderhelpdeskpb@gmail.com](mailto:etenderhelpdeskpb@gmail.com), [pavitar.s@tenderwizard.com](mailto:pavitar.s@tenderwizard.com)

1. Earnest Money and Tender form fees separately of required value shall be submitted in shape of DD of any Nationalised Bank payable in favour of The **Registrar**, Punjabi University Patiala. Tender fee, Earnest money must be reached on or before dated 16.5.18 till 10:00AM in the Office of the Head, Department of Electronics and Communication Engineering.
2. Tender Processing fee should be paid through e-payment (Direct Debit or Internet Banking)
3. The Tender documents shall be uploaded in 2 folders.
  - (i) Folder-A: Shall contain pre-qualification documents such as Registration, PAN No., GST, Income Tax Return and Non Black list Self certificate etc uploaded on website.
  - (ii) Folder-B: shall contain financial bid on the prescribed form.
4. In case earnest money is not deposited for not having the required value, the bids will not be considered and rejected straightaway.
5. The folder-B: shall be opened only of those contractors who will be found technically qualified for the supply.
6. Corrigendum /Addendum/Corrections, if any will be published in the web site only. Firm/Vendor shall continue to check the Web site [www.tenderwizard.com/PUNJAB](http://www.tenderwizard.com/PUNJAB)

**PRE-QUALIFICATION REQUIREMENTS: -**

1. Manufacturers/Suppliers/ AuthorizedDealers for Supply of Equipment categorized in the Project A and Project B can only participate.
2. The Supplier/Firm shall submit a copy of PAN No., GST No. etc.
3. The Supplier/firms shall submit copies of income tax return for the last 2 years.
4. The Supplier/firms shall also submit Self certification that they have not been debarred/blacklisted by any Govt./ Semi Govt. Organization or any Corporation at any stage.

**Purchase of Laboratory Equipment**  
**[Department of Electronics & Communication Engineering]**

<b>A (Analog Electronics Lab)</b>	
<b>Item No.</b>	<b>Specifications</b>
1.	<p><b>Analog Circuit/ Breadboard Development Platform</b></p> <p>Training Platform should have :</p> <ul style="list-style-type: none"> <li>➤ Functional blocks indicated on board mimic</li> <li>➤ On board DC and AC Power Supplies &amp;Function Generator</li> <li>➤ On board Continuity Tester ,Toggle switches and Potentiometers</li> <li>➤ Digital Display for Voltage/Current/Frequency measurement</li> <li>➤ PC Interface , Solderless breadboard</li> <li>➤ Technical Specifications:</li> <li>➤ Size of Breadboard : 172.5 mm x 128.5mm ;Tie Points : 1685 nos (solderless)</li> <li>➤ On Board DC Power Supplies: +5V, 1A (fixed) ; +12V, 500 mA (fixed) ; -12V, 500 mA (fixed) ;</li> <li>➤ 0 to +12V, 500 mA (variable) ;0 to -12V, 500 mA (variable)</li> <li>➤ AC Supply : 9-0-9V, 500mA</li> <li>➤ Function Generator : Sine, Square, and Triangular functions</li> <li>➤ Frequency range:1Hz to 100KHz In 5steps (variable in between the steps)</li> <li>➤ Voltage/Current/Frequency Measurement :</li> <li>➤ Voltage range: +12V to -12V (DC) ; Current range: 0 to 500 mA (DC)</li> <li>➤ Frequency range: DC to 100KHz (all with respect to ground)</li> <li>➤ PC Interface : Acquisition from two analog input channels (max. input 1V)</li> <li>➤ Continuity Tester : For testing the continuity (provided with beeper sound)</li> <li>➤ Mains Supply: 110-220V <math>\pm</math>10%, 50 Hz</li> <li>➤ Included Accessories : Breadboards (solderless) : 2 nos ; Connecting wires : 20 nos</li> <li>➤ 2mm to 1 mm patch cords: 8 nos ; 2mm to 2mm patch cords : 8 nos</li> <li>➤ Mains cord : 1 no ; Interface cable (microphone pin) : 1 no ; Software : 1 no</li> <li>➤ Casing : Trainer should be encased in a plastic moulded box with a cover to protect it from dust etc.</li> <li>➤ No components on the top of the Trainer only block diagram to be provided.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>

<b>B (Communication Systems Lab)</b>	
2.	<p><b>DPCM Modulation Kit</b> (PCM/DPCM/CVSD Modulation &amp; Demodulation)</p> <p>Training Platform should have :</p> <ul style="list-style-type: none"> <li>➤ VLSI based ; Transmitter and Receiver on same board.</li> <li>➤ Variable sampling rates with respective line speed.</li> <li>➤ Clock generation from 8MHz crystal Oscillator.</li> <li>➤ On-board DDS signal generators for five different signals.</li> <li>➤ On board 2nd order Butterworth low pass filter with cut-off frequency of 5KHz.</li> <li>➤ On board Channel effect for Channel analysis.</li> </ul> <p><b>Specifications :</b></p> <ul style="list-style-type: none"> <li>➤ Technology: VLSI</li> <li>➤ Modulation Technique : Pulse Code Modulation and Demodulation.</li> <li>➤ Differential Pulse Code Modulation and Demodulation</li> <li>➤ Continuously Variable Slope Delta Modulation and Demodulation</li> <li>➤ Crystal Frequency: 8MHz</li> <li>➤ Signal Generator: Sine, Square, Triangle, arbitrary signal etc.</li> <li>➤ Input Signal Frequency: 500Hz,1KHz,1.5KHz,2KHz,3KHz</li> <li>➤ Sampling Frequency: 4KHz, 8KHz, 16KHz, 32KHz</li> <li>➤ Line Speed: 32KHz, 64KHz, 128KHz, 256KHz</li> <li>➤ Noise Gain: Variable ; Low Pass Filter: Cut-off frequency 5KHz ; Test Points: 37nos.</li> <li>➤ Channel Effect :</li> <li>➤ Channel as a low-pass ; Channel as a attenuator ; Channel as a noise</li> <li>➤ Power Supply : 110-220 V, <math>\pm 10\%</math>, 50 Hz</li> <li>➤ Casing : Trainer should be encased in a plastic moulded box with a cover to protect it from dust etc.</li> <li>➤ No components on the top of the Trainer only block diagram to be provided.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
3.	<p><b>AM and FM Transmitter &amp; Receiver Kit</b> (Amplitude Modulation (SSB/DSB) Transmitter &amp; Receiver Training Platform &amp; FM Modulation &amp; demodulation Training Platform)</p> <p><b>Transmitter : Training Platform Should Have</b></p> <ul style="list-style-type: none"> <li>➤ On board Functional blocks with self explanatory waveforms and technical details indicated .Oscillator controlled carrier frequency ;LED indication for signal flow and selection. At least 25 nos. test points for waveform observation</li> <li>➤ At least 8 Switched faults for troubleshooting at different functional blocks</li> <li>➤ Telescopic antenna should be provided for transmission of AM signal</li> <li>➤ On board audio jacks should be provided for Microphone and Earphone connection. On board Speaker provided for audio communication</li> <li>➤ No components should be mounted on the top of the Trainer( except tuneable coils with protective covering on the top) only block diagram to be provided on the top.</li> <li>➤ Audio Oscillator : Adjustable Amplitude &amp; Frequency (300 Hz - 3.4 KHz)</li> <li>➤ Audio Output : Amplifier with speaker</li> <li>➤ Modulators : Balanced Modulator with Band pass Filter (1 MHz) - 2 nos.</li> <li>➤ Balanced Modulator : 1 No. (455 KHz) ;Ceramic Band pass Filter : 1 No. (455</li> </ul>

KHz)

- Carrier Frequency : 1 MHz (Oscillator controlled) ;Transmitter Amplifier Output: (Gain adjustable) DSB (1 MHz),
- SSB (1.445 MHz) connected to Antenna/cable
- Antenna: Telescopic with Radiation distance up to approx. 1 meters
- Switched Faults : 8 nos.; Test points: 27 nos

#### **Receiver Training Platform Should Have**

- On board Functional blocks with self explanatory waveforms and technical details indicated. On board Tuner provided for tuning the transmitting station
- LED indication for signal flow and selection ;At least 30 nos. test points for waveform observation and analysis
- 8 Switched faults for troubleshooting at different functional blocks
- Telescopic antenna for reception of AM signal
- On board audio jack & Speaker provided for audio communication
- Construction :Superhetrodyne Frequency Range :980 to 2060 KHz
- Intermediate Frequency :455KHz ;Input Circuit:1. RF amplifier 2. Mixer
- Local oscillator 980 to 2060 KHz 4. Beat Freq. Oscillator 5. IF Amplifier 6. IF Amplifier 2
- Tuning :Variable capacitor(Ganged) Dial marking on board : Range 525 to 1600 KHz
- Receiving Media :Telescopic Antenna/ Cable
- Detectors :1). Diode Detector (DSB) 2.) Product Detector (SSB)
- Audio Output :Amplifier With Speaker/ Headphone
- Switch able Automatic Gain Control ,Switched Faults:8 Nos. ; Test points: 30 nos

#### **FM Modulation & demodulation Training Platform**

Training Platform Should Have:

- on board Functional blocks with self-explanatory waveforms and technical details
- On board Audio Oscillator, Frequency modulators/demodulators, Mixer/Amplifier, Amplitude limiter & Filter.
- Effect of noise on the detection of FM signal may be investigated
- LED indication for signal flow and selection
- 40 nos. Test points for waveform observation and analysis
- 12 Switched faults for troubleshooting at different functional blocks
- No components should be mounted on the top of the Trainer( except tuneable coils with protective covering on the top) only block diagram to be provided on the top.
- Audio Oscillator : Sine wave (10Vpp adjustable) Frequency (300 Hz - 3.4 KHz)
- FM Modulators : 3 nos.
- Reactance Modulator : Carrier Frequency 455 KHz ( $\pm 3$ KHz) ;
- Varactor Modulator : Carrier Frequency 455 KHz ( $\pm 2$ KHz)
- VCO Based Modulator(IC XR2206 based) : Carrier Frequency 10 KHz - 200KHz (adjustable)
- Mixer / Amplifier : Allows FM input signal to be amplitude modulated by a noise
- input prior to demodulation, with gain adjustment.
- FM Demodulator : 6 nos.
- Detuned Resonant Detector ;Quadrature Detector ; Foster-Seeley Detector ; Ratio Detector

	<ul style="list-style-type: none"> <li>➤ Phase-Locked Loop Detector (IC HEF4046 based) ; Phase-Locked Loop Detector (IC LM565 based)</li> <li>➤ Low Pass Filter : 3.4 KHz Cut off Frequency Amplifier (with adjustable gain)</li> <li>➤ Amplitude Limiter : 1 no. ; Switched Faults : 12 nos.; Test Points : 40 nos</li> <li>➤ Common Specs for All Platforms:</li> <li>➤ Interconnection: 2 mm sockets &amp; Sufficient Nos of stackable patch cords .</li> <li>➤ Mains Supply : External Power supply with Input 110-220 V AC <math>\pm 10\%</math>, 50Hz</li> <li>➤ Cabinet Housing : Enclosed on a plastic box with a cover</li> <li>➤ No components on the top of the Trainer except Tuning coils , That too protected by Plastic covers , only block diagram to be provided in the top of the Training Boards .</li> <li>➤ Training Platform top should be on Legend PCB with Block Diagrams &amp; waveforms Printed on the top.</li> <li>➤ Accessories : Set of patch cord, Power cord.&amp; Power supply .</li> <li>➤ Should be supplied with Simulation &amp; Technology Teaching software with Detailed theory , Simulations &amp; Animations on Analog communication in USB Pen drive which should act as a Hardware lock also.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
4.	<p><b>TDM PCM Transmitter and Receiver Kit</b> (Time Division Multiplexing Pulse Code Modulation/Transmitter &amp; demodulation / receiver)</p> <p>Modulation Training Platform Should Have:</p> <ul style="list-style-type: none"> <li>➤ Crystal Frequency : 16 MHz</li> <li>➤ On Board Analog Signal : 2 KHz, 4 KHz (Sine wave synchronized to sampling pulse Adjustable amplitude and separate variable DC level)</li> <li>➤ Input Channels : 2 nos.; Multiplexing : Time Division Multiplexing</li> <li>➤ Modulation : Pulse Code Modulation ;</li> <li>➤ Sync Signal : Pseudo Random Sync Code Generator</li> <li>➤ Error Check Code : Off - Odd - Even - Hamming</li> <li>➤ Operating Mode : Fast : 320 KHz / channel approximately</li> <li>➤ Slow : 1.9 Hz / channel approximately ; Test Points : 50 nos ;</li> <li>➤ 4 Nos of Switched faults for different Error Check Options</li> <li>➤ Power Supply : 110-220 V, <math>\pm 10\%</math>, 50 Hz</li> </ul> <p>Demodulation/receiver Training Platform Should Have:</p> <ul style="list-style-type: none"> <li>➤ Should accept two channel Multiplexed data</li> <li>➤ On Board Low pass Filters , Fast &amp; Slow mode of operation ,</li> <li>➤ On Board PLL for clock regeneration ; On Board Sync code Detector , Error check code options , Odd or even parity -Single bit error detection ; Hamming code single bit error detection &amp; correction , Switched faults for different error check code options</li> <li>➤ Input Channel : Time Division Multiplexed serial Input</li> <li>➤ Demodulation : Pulse Code Demodulation</li> <li>➤ Clock Regeneration : By Phase Locked loop</li> <li>➤ Error Detection (Single bit) : Off-Odd- Even parity &amp; Hamming code</li> <li>➤ Error Correction : Hamming code ; Test Points : 50 nos.</li> <li>➤ Power Supply : 110-220 V, <math>\pm 10\%</math>, 50 Hz</li> <li>➤ Casing: Trainer should be encased in a plastic moulded box with a cover to protect it from dust etc.</li> <li>➤ No components on the top of the Trainer only block diagram to be provided</li> </ul>

	<ul style="list-style-type: none"> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
5.	<p><b>PAM/PPM/PWM Kit</b> (Pulse Amplitude /Pulse Position//Pulse Width Modulation&amp; Demodulation)</p> <p>Training Platform Should Have:</p> <ul style="list-style-type: none"> <li>➤ Modulator and Demodulator on same board</li> <li>➤ Different type of sampling, Natural, Flat top, sampled and hold</li> <li>➤ On-board DDS Signal Generator for standard and arbitrary signals</li> <li>➤ Selectable sampling frequencies for PAM &amp; Ramp frequencies for PWM and PPM</li> <li>➤ On board 2nd order Butterworth low pass filter</li> <li>➤ No components should be mounted on the top of the Trainer, only block diagram to be provided on the top. SMD LED Indicators</li> <li>➤ Modulation &amp; Demodulation Techniques: PAM ,PWM &amp; PPM , Line Coding Techniques</li> <li>➤ Internal Signal Generator: Direct Digital Synthesizer</li> <li>➤ Types of Signal : Sine, Square, Triangle, Arbitrary signals.</li> <li>➤ Frequency : 500Hz, 1KHz, 2KHz, 3KHz</li> <li>➤ External Signal :Types of Signal : Sine, Square, Triangle, Arbitrary signals</li> <li>➤ Maximum Input Voltage : 3Vpp (Max.) +1.5V DC offset; Frequency : 500Hz to 3.5KHz</li> <li>➤ Sampling/Ramp Frequencies : 1.25KHz, 2.50KHz, 5KHz, 9.80KHz, 19.53KHz, 39.06KHz, 78.13KHz</li> <li>➤ Crystal Frequency : 20MHz ; Selection Mode : Push switches</li> <li>➤ Random Data (For line Coding) : 8 Bit/ 16 Bit/ 32 Bit</li> <li>➤ Data Frequency : 500Hz, 1KHz, 2KHz, 3KHz ; Low Pass Filter : Cut-off frequency-5KHz</li> <li>➤ Test Points : 29 nos</li> <li>➤ Interconnection: 2 mm sockets &amp; Sufficient Nos of stackable patch cords .</li> <li>➤ Mains Supply : External Power supply with Input 110-220 V AC <math>\pm 10\%</math>, 50Hz</li> <li>➤ Cabinet Housing : Enclosed on a plastic box with a cover</li> <li>➤ Training Platform top should be on Legend PCB with Block Diagrams &amp; waveforms Printed on the top. Accessories : Set of patch cord, Power cord.&amp; Power supply .</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
6.	<p><b>DELTA/ADAPTIVE DELTA Modulation/Demodulation Kit</b> (DELTA, ADAPTIVE DELTA &amp; SIGMA DELTA Modulator &amp; Demodulator)</p> <p>Training Platform should have :</p> <ul style="list-style-type: none"> <li>➤ VLSI based</li> <li>➤ Transmitter and Receiver on same board.</li> <li>➤ Variable sampling rates., Clock generation from 8MHz crystal Oscillator.</li> <li>➤ On-board DDS signal generators for five different signal.</li> <li>➤ Selectable integrator gain setting (by switch or control circuit)</li> <li>➤ On board 2nd order Butterworth low pass filter with cut-off frequency of 5KHz.</li> <li>➤ On board Channel effect .</li> <li>➤ It should have following Technical Specifications:</li> <li>➤ Technology : VLSI</li> <li>➤ Modulation Technique : Delta Modulation and Demodulation. Adaptive Delta Modulation and Demodulation</li> </ul>

	<ul style="list-style-type: none"> <li>○ Sigma Delta First Order Modulation and Demodulation</li> <li>○ Sigma Delta Second Order Modulation and Demodulation</li> <li>➤ Crystal Frequency : 8MHz</li> <li>➤ Signal Generator : Sine, Square, Triangle &amp; arbitrary signal</li> <li>➤ Input Signal Frequency : 500Hz, 1KHz, 1.5KHz, 2KHz, 3KHz</li> <li>➤ Sampling Frequency : 16KHz, 32KHz, 64KHz, 128KHz, 256KHz</li> <li>➤ Noise Gain : Variable</li> <li>➤ Integrator(step size) : 1 &amp; 3</li> <li>➤ Low Pass Filter : Cut-off 5KHz frequency</li> <li>➤ Test Points : 45 or more (Golf Plated ).</li> <li>➤ Channel Effects : Channel as a low-pass-filter ; Channel as a attenuator ; Channel as a noise</li> <li>➤ Power Supply : 110-220 V, ±10%, 50 Hz</li> <li>➤ Casing : Trainer should be encased in a plastic moulded box with a cover to protect it from dust etc.</li> <li>➤ No components on the top of the Trainer only block diagram to be provided.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
7.	<p><b>MSK Trainer Kit</b> (Minimum Shift Keying Modulation &amp; Demodulation Training Platform)</p> <p>Training Platform should have :</p> <ul style="list-style-type: none"> <li>➤ Functional blocks indicated on board mimic ; On board Data &amp; Carrier Generator</li> <li>➤ On board Clock Generators ; MSK Modulator &amp; Demodulator</li> <li>➤ Data Source</li> <li>➤ Data rate : 16 Kbps ; Word Length : 15 bits ;Data Format : NRZ (Non Return to Zero)</li> <li>➤ Clock Source : 16 KHz, 8 KHz ; Carrier Generators : 32 KHz (Sinusoidal)</li> <li>➤ Pulse Shaping Waveform : 4 KHz ; Interconnections : 2 mm socket ; Test Points : 36</li> <li>➤ Casing : Trainer should be encased in a plastic moulded box with a cover to protect it from dust etc. No components on the top of the Trainer only block diagram to be provided</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
8.	<p><b>Data Formatting Trainer Kit</b> (Data Formatting &amp; Carrier Modulation Transmitter)</p> <p>Training Platform should have:</p> <ul style="list-style-type: none"> <li>➤ On-board Unipolar to Bipolar conversion. &amp; data inverter.</li> <li>➤ On-board 8-bit Data Source &amp; Clock Source</li> <li>➤ Data formats : NRZ (L), NRZ (M), RZ, AMI, RB, Biphase(Manchester), Biphase (Mark).</li> <li>➤ Carrier modulation : ASK, FSK, PSK, DPSK, QPSK</li> <li>➤ On-board carrier : Sine waves synchronized to transmitted data at 1.6 MHz, 960 KHz, (0 deg. phase) 960 KHz,</li> <li>➤ (90 deg. phase)</li> <li>➤ Test Points : 43 or more ; Interconnection: 2 mm ; Sufficient Nos of stackable patch cords</li> </ul>

	<ul style="list-style-type: none"> <li>➤ Power Supply : 110-220 V, <math>\pm 10\%</math>, 50 Hz</li> <li>➤ Casing : Trainer should be encased in a plastic molded box with a cover to protect it from dust etc.</li> <li>➤ No components on the top of the Trainer only block diagram to be provided.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
9.	<p><b>Data Reformatting Trainer Kit</b> (Data Reformatting &amp; Carrier Demodulation Receiver)</p> <p>Training Platform should have :</p> <ul style="list-style-type: none"> <li>➤ On - Board Biphase Clock recovery , data squaring &amp; Differential decoder circuit.</li> <li>➤ On - Board 4th Order Butterworth filters &amp; 8 bit Data Receiver</li> <li>➤ Input : From Data Formatting and Carrier Modulation/Transmitter Trainer</li> <li>➤ Data formats: 7 different data reconditioning formats NRZ (M), NRZ(L) ,RZ, AMI, RB, Biphase (Manchester), Biphase (Mark).</li> <li>➤ Carrier Demodulation : ASK - Rectifier Diode ,FSK PLL Detector PSK /DPSK- Square Loop Detector QPSK -Fourth Power Loop Detector</li> <li>➤ Biphase Clock Recovery : By PLL</li> <li>➤ Test points: 35 ; Interconnection: 2 mm sockets &amp; Sufficient Nos of stackable patch cords</li> <li>➤ Accessories : e Manual, Set of patch cord, Power supply.</li> <li>➤ Power Supply : 110-220 V, <math>\pm 10\%</math>, 50 Hz</li> <li>➤ Casing : Trainer should be encased in a plastic moulded box with a cover to protect it from dust etc.</li> <li>➤ No components on the top of the Trainer only block diagram to be provided.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
10.	<p><b>Sampling &amp; Reconstruction Kit/Training Platform</b></p> <p>Training Platform Should Have :</p> <ul style="list-style-type: none"> <li>➤ Crystal controlled pulse generator ; On-board synchronized analog signal generator</li> <li>➤ Six switch selectable sampling frequencies ; Sampling pulse duty-cycle selectable</li> <li>➤ Internal/External sampling signal selectable ; Separate sample and sample/hold outputs</li> <li>➤ On-board second order and fourth order low-pass filters</li> <li>➤ Audio Input and Output links to show the transmission and reception of real time signal (audio signal)</li> <li>➤ Crystal Freq. : 8 MHz ;Sampling Freq.: 20, 50, 80, 100, 200 &amp; 400 KHz (switch selectable)</li> <li>➤ On-board Generator : Synchronized 1 KHz sine wave (5 V ) pp</li> <li>➤ Duty cycle : 0 - 90% in Decade steps (switch selectable)</li> <li>➤ Low Pass Filters : 2nd &amp; 4th order Butterworth filters</li> <li>➤ Cut-off frequency : 3.4 KHz each ; Test Point : 50 nos.</li> <li>➤ Power Supply : 110-220 V, <math>\pm 10\%</math>, 50 Hz</li> <li>➤ Casing : Trainer should be encased in a plastic moulded box with a cover to protect it from dust etc.</li> <li>➤ No components on the top of the Trainer only block diagram to be provided.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
11.	<b>FDM Trainer Kit</b>



	<p>(Frequency Division Multiplexer /Demultiplexer Kit/Training Platform)</p> <p>Training Platform Should Have:</p> <ul style="list-style-type: none"> <li>➤ Two variable modulating (sinusoidal) input channels with provision of voice inputs</li> <li>➤ Two DSBSC modulators for frequency band translation of two test signals</li> <li>➤ Two Carrier Generators ; Two sets of audio input amplifier</li> <li>➤ One adder/transmission amplifier ; Two Demodulators ; Two L.P filters, Two Sets of audio O/P amplifier, Crystal Frequency : 4.096 MHz</li> <li>➤ Carrier Generator : Sine wave 100 KHz&amp; 200 KHz</li> <li>➤ Modulating Input Frequency : Sine wave 200 Hz - 10 KHz (variable)</li> <li>➤ Audio Input Amplifier : Gain of 100 (approx.)</li> <li>➤ Modulator / Demodulator : DSBSC Modulator/Demodulator</li> <li>➤ Low Pass Filters : Second Order Butterworth filters , cut off frequency of 10 KHz</li> <li>➤ Audio Output Amplifier : Output Amplifier with a gain of 20</li> <li>➤ Test points : 30 nos, Interconnection: 2 mm sockets &amp; Sufficient Nos of stackable patch cords .</li> <li>➤ Mains Supply : External Power supply with Input 110-220 V AC <math>\pm 10\%</math>, 50Hz</li> <li>➤ Cabinet Housing : Enclosed on a moulded plastic box with a cover</li> <li>➤ Training Platform top should be on Legend PCB with Block Diagrams &amp; waveforms Printed on the top.</li> <li>➤ Accessories : Set of patch cord, Power cord.&amp; Power supply .</li> <li>➤ Should be supplied with Simulation &amp; Technology Teaching software with Detailed theory , Simulations &amp; Animations on Analog communication in USB Pen drive which should act as a Hardware lock also.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
<b>C (Wireless Communication Lab)</b>	
12.	<p><b>IOTKit</b> (Internet of Things Training System)</p> <p>Training system should have features like :</p> <ul style="list-style-type: none"> <li>➤ Processor:1.2 GHz ARMv7 Quad core Processor</li> <li>➤ Memory:1GB RAM and 16GB SD Card external</li> <li>➤ Operating System: Linux Based design,</li> <li>➤ Communication : Connectivity : 802.11 b/g/n Wireless LAN ; Bluetooth 4.1, zigbee, USB &amp; Ethernet Interface : I2C , SPI &amp; RS485 Interface</li> <li>➤ On Board Stepper motor &amp; Zigbee Coordinator</li> <li>➤ LCD: on board Color TFT</li> <li>➤ Ethernet : 10/100 BaseT Ethernet socket</li> <li>➤ Video Output : HDMI and Composite RCA</li> <li>➤ Audio Output : Audio Output 3.5mm jack</li> <li>➤ USB : 4 nos.</li> <li>➤ Camera : 15-pin MIPI Camera Serial Interface</li> <li>➤ Memory Card : Push/pull Micro</li> <li>➤ Motor Driver : Stepper and DC Motor</li> <li>➤ Analog Input : 8 nos. ; Relay Output : 4 nos. ; Buzzer Output : 1 no.</li> <li>➤ Zigbee Frequency : 2.4GHz ; Power : 5V, 2A</li> </ul> <p><b>Wireless Sensor Node</b></p> <ul style="list-style-type: none"> <li>➤ Analog Inputs : 6 nos.; Digital Outputs : 4 nos.</li> </ul>

	<ul style="list-style-type: none"> <li>➤ I2C channel : 1 no. ;Communication : Zigbee 2.4 GHz</li> <li>➤ PC Interface : USB ; Charging : USB and Solar Panel</li> <li>➤ Battery : 3.7V/4400mAH ;Solar Panel : 6W,</li> </ul> <p><b>Included Sensors :</b></p> <ul style="list-style-type: none"> <li>➤ Temperature and Humidity : 2 nos.; Air Quality Sensor : 2 nos.; Soil Moisture : 2 nos.</li> <li>➤ Ambient Light Sensor : 2 nos. ; Soil/Water temperature : 2 nos.PIR Sensor : 2 nos.</li> <li>➤ 4 Channel ADC for Voltage</li> <li>➤ Input ; 1 Channel For Resistance</li> <li>➤ Input ; 1 Channel For 4-20mA Input</li> <li>➤ 8 Nos. LED ; Motor Driver Circuit ; Serial to USB Converter</li> </ul> <p><b>Wireless Sensor Node (End/Router Device)</b></p> <ul style="list-style-type: none"> <li>➤ 3 nos</li> <li>➤ Analog Input 12 nos ;Digital Input 6 nos</li> <li>➤ I2C Communication 2 nos ; Housing :IP65 Box ;Solar Panel for Charging</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
13.	<p><b>Wireless LAN Trainer Kit</b></p> <ul style="list-style-type: none"> <li>➤ Wireless LAN Trainer with 4 wireless Nodes</li> <li>➤ PC to PC comm.with IEEE 802.3 ; Peer to Peer, Client - Server network</li> <li>➤ Design of Star topology using 100Base-Tx ;Design of Bus topology using 10Base-2</li> <li>➤ Design of Ring topology using DB9 ; Simulation of Distance Vectors and Link State Algorithms ; Socket Programming exercise for LINUX ; Encryption/Decryption Technique</li> <li>➤ Type of Encryption &amp; Decryption : WEP 64/128 bit ;Wireless access point should be Provided ;</li> <li>➤ Facility to send all types of files over LAN.</li> <li>➤ Detailed introduction to TCP/IP Model (4 Layer Model) ; Video Tutorials for software operation ; Creation of cables for network connections ; Network design using RJ45 &amp; DB9 connectors ; Socket programming and processing ; Wireless LAN with 803.11b/g</li> <li>➤ Various LAN Protocols ; Data rate up to 100Mbps</li> <li>➤ Antenna power in dB watt used for wireless : 5dBi high gain ; Type : Strip line Monopole</li> <li>➤ Data transmission Speed in wireless : 150 Mbps max ; Variable packet size &amp; Variable packet delay ; Error generation (Manual and Auto)</li> <li>➤ Color coded real time graphical representation of transmission &amp; reception</li> <li>➤ Graphical Analysis of LAN performance with various parameters and protocols</li> <li>➤ Save / Print option for graphs ,User friendly software ; Switch faults in both hardware &amp; software ; Exhaustive course material &amp; references</li> <li>➤ Hardware :</li> <li>➤ PC to PC using RJ-45 Connector , Star topology using RJ45 Connector ,</li> <li>➤ Bus topology by using end terminator ; Ring topology using DB9 Connector</li> <li>➤ Data transmission speed: 10/100 Mbps ; 4 wireless Nodes</li> <li>➤ Software:</li> <li>Star, Bus &amp; Ring selection; Protocols: CSMA/CD, CSMA/CA, Stop N Wait, Go back to N, Selective repeat, Sliding Window, Token Bus, Token Ring</li> <li>➤ Packet size: 128, 256, 512, 1024, 2048, 4096, 8192, 16384 ; Inter Packet delay:</li> </ul>

	<p>1000 – 5000 ms</p> <ul style="list-style-type: none"> <li>➤ Error generation: Acknowledgment lost, bad packet, auto error generation</li> <li>➤ Graphical Representation: Real time Graphic representation of data on s/w screen with packet details</li> <li>➤ Network details: Indication of computer name, IP address, MAC address, Port number, status of network.</li> <li>➤ Network &amp; protocol analysis: Indication of packet serial number, file name, file size, file number, receiver name, receiver IP address , total packets, packet length, time out, protocol, topology, receiver, MAC address, port number, file send start time, file sent completion time, transmission time data rate(Mbps),percentage error. Detection of collision on live network.</li> <li>➤ Interconnection: 2 mm sockets &amp; Sufficient Nos of stackable patch cords</li> <li>➤ Mains Supply : Power supply with Input 110-220 V AC <math>\pm 10\%</math>, 50Hz</li> <li>➤ Trainer should have no components on the top of the board &amp; should be encased in a plastic moulded case with cover on the top.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
14.	<p><b>Satellite Communication Trainer</b></p> <ul style="list-style-type: none"> <li>➤ Simultaneous communication of three different signals</li> <li>➤ Communicate Audio, Video, Digital data, PC data, Tone, Voice, function generator waveforms etc.</li> <li>➤ 2414 - 2468 MHz PLL microwave operation</li> <li>➤ Communication of external broad band digital signal</li> <li>➤ Choice of different transmitting and receiving frequencies</li> <li>➤ Remote detection of Light intensity and environment temperature</li> <li>➤ Detachable Dish Antenna at each station</li> </ul> <p><b>Uplink Transmitter:</b></p> <ul style="list-style-type: none"> <li>➤ Transmitter with selectable frequency conversion</li> <li>➤ 2450-2468 MHz up-linking selectable frequencies</li> <li>➤ Wide band RF amplifier. No manual matching required.</li> <li>➤ 16 MHz Bandwidth ; Frequency select switch and LED indication.</li> <li>➤ FM Modulation of Audio and Video.</li> <li>➤ Coverage area 35m Indoor and 80m outdoor</li> <li>➤ Transmit Audio, Video, Digital data, PC data, Tone, Voice, function generator waveforms etc. Separate section for telemetry operation.</li> <li>➤ Inbuilt Tone generator: Freq: 100Hz to 1KHz.; Amplitude: 0Vto1Vpp.</li> <li>➤ Separate terminals provided for different inputs.</li> <li>➤ Interface : USB interface for PC-PC communication</li> <li>➤ Power Supply: 230V AC <math>\pm 10\%</math>, 50 Hz.</li> </ul> <p><b>Satellite Link:</b></p> <ul style="list-style-type: none"> <li>➤ Transponder with selectable Uplink and downlink freq.</li> <li>➤ Light and Temperature sensors for telemetry operations.</li> <li>➤ Delay knob provided for simulated Transition delay experiment.</li> <li>➤ Optional Solar power supply for Transponder Unit.</li> <li>➤ Detachable Dish Antennas.Power Supply: 230V AC <math>\pm 10\%</math>, 50 Hz.</li> </ul> <p><b>Downlink Receiver:</b></p> <ul style="list-style-type: none"> <li>➤ Receiver with selectable frequency conversion.</li> <li>➤ Receives and demodulate three signals simultaneously.</li> <li>➤ Built in speaker for audio and video output. Detachable Dish Antenna.</li> <li>➤ Interface : USB interface for PC-PC communication</li> </ul>

	<ul style="list-style-type: none"> <li>➤ Power Supply: 230V AC <math>\pm 10\%</math>, 50 Hz. Accessories: Necessary Video &amp; data cables.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
15.	<p><b>CDMA-DSSS Modulator &amp; Demodulator Kit</b></p> <p>Training System should have:</p> <ul style="list-style-type: none"> <li>➤ Complete CDMA-Direct Sequence Spread-Spectrum (DSSS) system</li> <li>➤ Customized real-time software</li> <li>➤ Analysis in Digital time, Analog time, and Frequency domain</li> <li>➤ Separate CDMA-DSSS Modulator and Demodulator</li> <li>➤ More than 25 nos. of test point</li> <li>➤ On-board BNC connector for Analog I-Q signal analysis</li> <li>➤ Software based variable Chip rate up to maximum 10Mchip/s</li> <li>➤ User selectable different types of Gold code , MLS &amp; Barker code</li> <li>➤ Spreading codes :</li> <li>➤ Gold sequences (up to <math>2^{23} - 1</math> chips)</li> <li>➤ Maximal length sequences (maximum length to <math>2^{23} - 1</math> chip)</li> <li>➤ Barker codes (length 11, 13)</li> <li>➤ Facility for User to design his own Gold / MLS code</li> <li>➤ Time and Frequency domain analysis and measurement of baseband BPSK, QPSK and OQPSK Modulation with output spectral shaping I-Q filter.</li> <li>➤ Built-in I &amp; Q channel root-raised Cosine filter for spectral shaping.</li> <li>➤ Built-in Digital Data Generator</li> <li>➤ Built-in additive White Gaussian noise (AWGN) Generator for analysis of noise gain effect on the Signal</li> <li>➤ Built-in Frequency offset (Doppler) Generator for analysis of frequency offset effect on the Signal</li> <li>➤ Measurement of BER with internal data which is being transmitted</li> <li>➤ Measurement of BER with different SNR</li> <li>➤ Internal generation of pseudo-random bit stream and un modulated carrier for test purposes</li> <li>➤ I &amp; Q Channel DAC-10 bit @ Sampling rate 125 MSPS max.</li> <li>➤ Anti-aliasing low pass filter with 3dB bandwidth of I &amp; Q channel</li> <li>➤ filter: Sallen Key 6-pole Butterworth with cut-off frequency 13MHz</li> <li>➤ Power Supply: 110-220 V AC <math>\pm 10\%</math>, 50Hz</li> <li>➤ Accessories: 40-pin FRC cable ;Power Supply &amp; Patch cord .</li> <li>➤ Host to Device USB cable; BNC to BNC &amp; Power cords.</li> <li>➤ Cabinet Housing : Enclosed on a moulded plastic box with a cover</li> <li>➤ No components on the top of the Modules only block diagram to be provided.</li> </ul> <p>Warranty: 3 Years &amp; Above</p>
<b>D (Optical Communication Lab)</b>	
16.	<p><b>WDM Trainer Kit</b> (Training Platform for Wavelength Division Multiplexing System)</p> <p>Training Platform should have:</p> <ul style="list-style-type: none"> <li>➤ 15 Bit Data Generators</li> <li>➤ 1310nm &amp; 1550nm Laser sources with external signal modulation facility</li> <li>➤ Functional Block Indicated on-board mimic ; RS232 PC Interface</li> <li>➤ Data Generators : 2 nos. (15 Bit Data) ; Comparators : 2 nos. (5V TTL Output)</li> <li>➤ Light Sources : 2 nos, Laser</li> </ul>

	<ul style="list-style-type: none"> <li>➤ Diode, Power Output -3dB</li> <li>➤ Optical Detectors : 2 nos, Photo Diode, Measuring Range +3dB -50dB</li> <li>➤ WDM Coupler : 2X1, Coupling Ratio 50:50,</li> <li>➤ Operating Wavelengths (all) : 1310nm &amp; 1550nm</li> <li>➤ Connector types (all) : FC</li> <li>➤ PC-PC Communication : Using 2 Channels (RS-232 Port)</li> <li>➤ Accessories: Mains cord, Patch cords &amp; RS 232 interface cable</li> <li>➤ Mains Supply : 230 V <math>\pm</math>10%, 50 Hz</li> <li>➤ Trainer should be housed in a Molded Plastic box.</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>
17.	<p><b>Optical Fiber Mode Characteristics Kit</b></p> <p>The setup should have</p> <ul style="list-style-type: none"> <li>➤ Set up for Numerical Aperture measurement and V number verification for Single Mode &amp; Multi Mode fiber cables</li> <li>➤ Complete set up for observation of intensity patterns of modes in Single Mode and Multi-Mode fiber cables</li> <li>➤ He-Ne LASER Source (650nm; 2mW) with mounting stand and fiber coupler</li> <li>➤ Single Mode &amp; Multi Mode fibers with SMA connectors at each end</li> <li>➤ Numerical Aperture measurement/ Mode observation screen with holding assembly</li> <li>➤ Optics bench with fiber coupling assembly and customized mechanical fixtures</li> <li>➤ The set up should have :</li> <li>➤ Optical Source Source Type : He-Ne LASER source. Wavelength : 650 nm Output Power : 2mW</li> <li>➤ LASER to fiber coupler : Coupling efficiency : &gt;70% for SM fiber &gt; 90% for MM fiber</li> <li>➤ Single Mode fiber cable Connector type : Standard SMA Cable type :</li> <li>➤ Step indexed, Glass cable Core diameter : 9 microns Refractive indices : Core: 1.52; Cladding : 1.48 Numerical Aperture : 0.13 Central wavelength : 1300 nm to 1600 nm</li> <li>➤ Multi-Mode POF cable Connector type : Standard SMA Cable type : Step indexed, Polymer fiber cable (POF) Core diameter : 1000 microns Refractive indices : Core: 1.49; Cladding: 1.42, Numerical Aperture: 0.5, Central wavelength : 650 nm to 1300 nm</li> <li>➤ Fiber length : 1.0 m</li> <li>➤ Power Supply : 110-220V, <math>\pm</math> 10%, 50 Hz ;Power consumption : 10 VA (approximately)</li> <li>➤ List of Accessories/Contents : He-Ne LASER source with mounting stand, Mains cord &amp; Optics bench : 1no Optics bench stands with bolts : 2nos Numerical Aperture measurement / Mode observation screen : 1no NA measurement / Mode observation screen holder with base and screws : 1no Fiber coupling assembly with base and screws : 1no Single Mode fiber optic cable, length 1 meter : 1no Multi Mode fiber optic cable, length 1 meter. : 1no Measuring scale (6 inches) : 1no Plastic box for cables : 1no</li> <li>➤ Warranty: 3 Years &amp; Above</li> </ul>

**Terms and Conditions: -**

1. One unit of each of the above kits specified is to be purchased and the unit price must be quoted inclusive of all taxes and levies in INR.
2. Payment will be released on successful installation and commissioning of purchase items as per Punjabi University, Patiala rules.
3. Order can be placed to different vendors and only one vendor will be selected.
4. All items to be supplied must be branded and shall be amply supported onsite warranty directly by OEM.
5. The material is to be made available/ installed within two weeks from date of placing confirmed Purchase Order along with all the bills.
6. If there is holiday on the receipt/opening day of the tender, the tender may be received/ opened on the next working day at the same time and at the same place.
7. The Purchase Committee reserves the right to reject the tender without assigning any reason before/after opening of the tenders and the tenderers shall have no right or any claim what so ever for the same on this account.
8. University reserves the right to increase/ decrease the quantity of items. The order for quantity of different items can be increased or decreased.**The supply order will be placed to the firm/Supplier which would submit quotation strictly as per the given detailed technical specifications.**The Suppliers/ Tenderers shall have no right or any claim what so ever for the same on this account. The payment for passive components will be made on the basis of actual consumption.
9. The rate quoted by the Supplier/Tenderer shall be inclusive of all the taxes i.e. GST or any other taxes levied by Central Govt. or State Government Authority or Local Bodies including their variations as notified by the Concerned Authority from time to time and of all the new taxes and levies that may be imposed. Firm will supply the material on quoted Rates which include F.O.R., Loading, Unloading, stacking and inclusive of all taxes. Nothing Extra shall be paid.
10. The Supplier/ Tenderer/Manufacturer shall comply with the proper by- Laws and legal order of the local body or authority under the jurisdiction of which the supply is executed and pay all fees and charges for which he may be liable. Nothing extra shall be payable by the University on this account.

11. In case of failure of supply of material as per ordered specifications, the University reserve the right to reject the supply order and can forfeit the earnest money deposited by the firm.
12. In case of any dispute, the jurisdiction will be Patiala Local Court (Punjab) only.
13. In case of any clarification regarding tender contact Phone No. **0175-3046338**
14. **Lab Equipment related specific conditions have been mentioned in the technical specifications also.**

Head  
ECE Department  
Punjabi University, Patiala.  
01753046338