National Institute of Technology Sikkim
Barfung Block, Ravangla, South Sikkim Pin Code-737139

INVITATION LETTER

Package Code: TEQIP-III/2019/ntst/90
Package Name: NITS/TEQIP-III/ECE/02

Current Date: 09-Apr-2019
Method: Shopping Goods

Sub: INVITATION LETTER FOR NITS/TEQIP-III/ECE/02

Dear Sir,

1. You are invited to submit your most competitive quotation for the following goods with item wise detailed specifications given at Annexure I,

Sr. No	Item Name	Quantity	Place of Delivery	Installation Requirement (if any)
1	Equipment for Basic Electronics and Communication Lab	1	NIT Sikkim, Ravangla, South Sikkim - 737139	Required

2. Government of India has received a credit from the International Development Association (IDA) towards the cost of the **Technical Education Quality Improvement Programme [TEQIP]-Phase III** Project and intends to apply part of the proceeds of this credit to eligible payments under the contract for which this invitation for quotations is issued.

3. **Quotation**

3.1 The contract shall be for the full quantity as described above.

3.2 Corrections, if any, shall be made by crossing out, initialling, dating and re writing.

3.3 All duties and other levies payable by the supplier under the contract shall be included in the unit Price.

3.4 Applicable taxes shall be quoted separately for all items.

3.5 The prices quoted by the bidder shall be fixed for the duration of the contract and shall not be subject to adjustment on any account.

3.6 The Prices should be quoted in Indian Rupees only.

4. Each bidder shall submit only one quotation.

5. Quotation shall remain valid for a period not less than **45**days after the last date of quotation submission.

6. Evaluation of Quotations: The Purchaser will evaluate and compare the quotations determined to be Substantially responsive i.e. which

6.1 are properly signed; and

6.2 Confirm to the terms and conditions, and specifications.

7. The Quotations would be evaluated for all items together.

8. Award of contract The Purchaser will award the contract to the bidder whose quotation has been determined to be substantially responsive and who has offered the lowest evaluated quotation price.

8.1 Notwithstanding the above, the Purchaser reserves the right to accept or reject any quotations and to cancel the bidding process and reject all quotations at any time prior to the award of Contract.

8.2 The bidder whose bid is accepted will be notified of the award of contract by the Purchaser prior to expiration of the quotation validity period. The terms of the accepted offer shall be Incorporated in the purchase order.

9. Payment shall be made in Indian Rupees as follows:

Satisfactory Delivery & Installation - 10% of total cost
Satisfactory Acceptance - 90% of total cost

10. Liquidated Damages will be applied as per the below:
Liquidated Damages Per Day Min % : 0
Liquidated Damages Max % : 10

11. All supplied items are under warranty of **24** months from the date of successful acceptance of items and AMC/Others is **NA.**

12. You are requested to provide your offer latest by **17:30** hours on **13-May-2019.**

13. Detailed specifications of the items are at Annexure I.

14. Training Clause (if any) **YES**

15. Testing/Installation Clause (if any) **YES**

16. Performance Security shall be applicable**: 0%**

17. Information brochures/ Product catalogue, if any must be accompanied with the quotation clearly indicating the model quoted for.

18. Sealed quotation to be submitted/ delivered at the address mentioned below, **National Institute of Technology Sikkim,Barfung Block, Ravangla, South Sikkim Pin Code-737139**

19. We look forward to receiving your quotation and thank you for your interest in this project.

09/01/19

Dr. Achintesh N. Biswas
Nodal Officer (Procurement)
Nodal Officer (Procurement)
TEQIP-III
National Institute of Technology Sikkim

Annexure - I

SR NO	Item Name	Specification
1	**BASIC ELECTRONICS TRAINER AND SPICE SIMULATION SOFTWARE** a. Discrete Component Trainer b. Transistor Application Trainer c. Op-Amp Trainer d. Network and Bridge Trainer e. Analog to digital and digital to analog converter trainer f. Analog and digital IC trainer g. Digital IC Trainer h. Analog, Digital and Mixed Signal Electronic circuit simulation software	The Basic Electronics Trainers should consist of the following 7 Modules along with SPICE Electronic Circuit Simulation Software: **a. Discrete Component Trainer** Should be a single board system over basic semiconductor devices such as diodes, BJT, FET, MOSFET, UJT, PUT, DIAC, TRIAC, SCR, IGBT. IEEE symbol of all components should be provided on the PCB.On-board components:On-board resources such as resistor, capacitor, diode and Potentiometer banks of different values should be available, On-board Relay and Opto-coupler,On-board variable regulated dual power supply (500mA) range from 0V to 30V,On-board dual power supply (500mA) range from 0V to 30V,On-board External AC power range from -12V to +35V,Resistor range from 100E to 200kΩ,Capacitor range from 0.1μF to 100 μF,Inductor (1mH)Potentiometer(10K) Good quality Breadboard (175mmX63mm) should be provided • Semiconductor Device Range: •Germanium Diode(1N60) •Fast Switching Diode(1N4148) • ZenerDiode(5.1V) • Light Emitting Diode (GREEN LED 5mm) • Bipolar Transistor PNP • Uni-Junction Transistor 2N2646 (UJT-N channel) • Field Effect Transistor (JFET BF245) • MOSFET(IRF-Z44N) • DIAC(DB3) • TRIAC (BT136) • IGBT (IRG4BC30S) • Silicon Controlled Rectifier (SCR TYN604) • Voltage Dependent Resistor(VDR) • Opto-Coupler (MCT2E) • Varactor Diode (1N4007) • Relay **b. Transistor Application Trainer** • All Components must be visible clearly on the top of the PCB. • Should be a single board system capable of covering ,the basic applications of transistors such as BJT, FET, MOSFET, UJT, etc. • IEEE Symbol of all components to be provided on the PCB • On-board resources such as resistor, capacitor, inductor, diode and Potentiometer banks of different values are

SR NO	Item Name	Specification
		provided. • On-board variable regulated and isolated power supplies • Dual Isolated power supply • Range 1 with GND from +35 V to – 35V • Range 2 with AGND 300mA from +12V to – 12V • 2 Helical pots to control the voltage • Dual DC Variable On-Board power supply 0 V to 30 V • Application study of different types of transistors like general purpose different NPN transistors like BC107,2N2222 and BD138 PNP transistor and power transistor like SL100 . • Also other types of transistors like FET (BF245), MOSFET (IRF-Z44N) and UJT (2N-2646) are present on board. • Resistor bank : 54 from 100 E to 1MΩ,Capacitor bank :27 from 0.47µF to 220 pF • Inductor bank : 09 from 1µH to 2.2mH,Potentiometer bank : 08 from 1 K to 1 M • Diodes bank ,Rectifier diode (1N4007) 0 to 4,Zener diode (5.1V),1 LED- Green • Good quality breadboard should be available(175mm*63mm) **c. Op-Amp Trainer** • Should be a single board system capable of covering Op-Amp (741) & its various applications • Allows study of timer using 555 IC, IEEE Symbol of all components to be provided on the PCBOn-board components: • On-board resistor, capacitor, diode and potentiometer bank of different values. • Breadboard (175mmX63mm) area allows construction of circuits using external components along with on board resources. • On-board fixed power supply and variable regulated positive & negative power supply. • LM331 IC should be provided with all the respective pin outs • DC power supply (300mA) with Helical pot on board to vary the voltage of ±5 V and ±12 V • DC Variable power supply with Helical pot on board to vary the voltage of ±1.5 V and 10 V Semiconductor Device Range: • Three IC 741 Op-Amp stage, One 555 IC stage,4 diode (1N4007),2 Zener diode (5.1V) • Transistor: BJT(BC547), MOSFET (IRF-Z44N),Green LED 5mm , • 16 pin ZIF socket with pin out to be provided on board.

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		• 45 Resistors bank from 100 E to 10MΩ,16 Capacitors bank from 56pF to 220µF,6 pots of 1kΩ to 10MΩ **d. Network and Bridge Trainer** • Should be a single board system capable of covering the basic theorems, the two port network parameters, different AC bridges and Analysis of network • On-board power supply, resistor, capacitor, inductor bank • On-board dual isolated power supply 0 to 20 V • Variable current source • 54 Resistors from 4.7 E to 150 K,12 Capacitor (fixed and variable) 33pF to 47µF, Gang capacitors of pF and µF, 8 Inductor bank from 1mH to 10 µH • Potentiometer bank 4 from 1 K to 100 K •Good quality breadboard should be available(175mm*63mm),Interconnection points and test points **e. Analog to digital and digital to analog converter trainer** It should consist of 8-bit binary weighted and 8-bit ladder type DAC are constructed using discrete components It should consist of 8-bit monolithic DAC having settling time in the range of ns, wide power supply range, low power consumption, full scale error + 1LSB 8-bit digital ramp ADC constructed using discrete components should be included. It should provide 12-bit monolithic ADC having conversion time in the range of µs, industry standard pin out, wide input range Should include 8 onboard switches to provide digital inputs to DAC Should include 8-bit counter running on external clock frequency to study settling time of DAC It should consist of Built in low frequency clock generator • 1 KHz sine wave with adjustable amplitude level should be provided. • Onboard variable DC voltage source for studying unipolar and bipolar modes of ADC should be provided • Should include 12 output LEDs to observe ADC outputs • Should provide ADA operates on DC power supply (+12V,-12V,+5V and GND) • Interconnection should be provided by standard 2mm connector • Extensive experimental manual is to be provided with the kit **f. Analog and digital IC trainer** • High level, high quality digital-analog trainer • It should combine all essential functions of analog and digital experiment with removable breadboard, includes DC power supply, function generator, two pulse switches, 8 Ω 0.5W speaker

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		• Solder-less bread board should be interconnected with tie points Nickel plated contact, fitted with all DIP sizes and all components with lead and solid wire. It can be changed and replaced for different purposes and can be connected with demonstration panel. Therefore, it is very convenient for both teachers and students • It should consist of Fixed DC output power supply of ±5V, ±12V@500mA • It should include Dual Variable DC output power supply,0~30V,0~-30V@500mA • It should consist of AC power supply of 5~0~5VAC,12~0~12VAC • Potentiometers of 1K Ω, 10KΩ should be included • It should consist of **Function generator with following frequency range.** Frequency range : 1Hz~10Hz 10Hz~100Hz 100Hz~1KHz 1KHz~10KHz 10KHz~100KHz • It should consist of **Amplitude with following readings** 1.Sine wave output : 0~4Vpp variable@1Hz ~1MHz in step of 5 2.Triangle wave output .0~4Vppvariable@1Hz ~300KHz in step of 5 3.Square wave output : 0~5Vpp variable@1Hz ~ 400KHz in step of 5 4.TTL mode output : 5V@1Hz~1MHz in step of 5 • It should have Two digits of 7 segment LED display • Should have Two pulse switches to generate inverting and non inverting pulses supported with de-bounce elimination • It should provide Toggle switches and corresponding output point. When switch is set at "Down" position, the output is LO level, contrarily it is to be 'High' level while setting at "Up" position • Speaker of8□□/ 0.5W to be used for load is to be provided • It should consist **Four channel adapter** The two banana sockets and BNC jacks suitable for the trainer to be connected with peripherals • It should consist **Sixteen bit LED display** **g. Digital IC Trainer** • Should be a single board system capable of covering minimum 10 Experiment • Should be designed using a Lattice CPLD Chip LC4128ZE covering all the Digital IC's as mentioned in the specification • IEEE Symbol of all components to be provided on the PCB • On-board Power supply (7.5V,300mA)

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		• Basic logic gate IC's:NOT (7404),OR (7432),AND (7408),NOR (7402),NAND (7400),EX-0R (7486) ,NAND and NOR gates as Universal Logic Gates,TTL to CMOS and CMOS to TTL Interface,Half Adder, Full Adder, Half Subtractor, Full Subtractor, Basic Flip-Flops:RS (using NOR),JK (7476),D (7474), D (7474) ,T (using JK) Counters:Synchronous Binary Counter (74191),4 Bit Ring Counter using 7476 Decade / BCD counter using 7490 • Universal Shift register 74194,,9 bit parity Generator / Checker (74280) • Multiplexer (74153) and Demultiplexer (74138) • BCD to seven segment decoder (7447) & Seven segment display • 1 bit Comparator (7185) • Binary to Gray, Gray to Binary, Binary to BCD, BCD to Binary, BCD to Excess 3, Excess 3 to BCD,16 switches to provide Logic 0 & 1 inputs,16 LEDs to observe the output logic states Manual clock, present and clear to observe the counter operation ,20 pin ZIF socket **h. Analog, Digital and Mixed Signal Electronic circuit simulation software** • Should be a perpetual license and capable of simulating analog and digital circuits. • Analysis possible: transient, dc bias, ac sweep, sensitivity analysis, distortion, noise, network analysis, etc. • A large number of "black box" blocks performing signal processing and conditioning functions such as gain block, summer, multiplier, divider, differentiator, integrator, limiter, etc. • A large variety of sources and excitation waveforms, including sine, square and triangle waves, single-tone modulated signals, nonlinear dependent sources and arbitrary waveforms defined through mathematical expressions • Curve tracer circuits to examine the behavior of an active device before you place it in your circuit • Continuous (perpetual) transient simulation should be possible to vary live circuit parameters while the simulation is running • Virtual instruments: oscilloscope, function generator, ammeter, voltmeter, wattmeter, distortion meter, gain meter, power supply, transient signal recorder to be

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		used during a live continuous simulation • Should have a Device Database & Editor • A large selection of active device models (diode, BJTs, FETs, MOSFETs, • MESFET's, operational amplifiers, etc) with no less than six distinct MOSFET models including BSIM3 and BSIM4 • "Real-world" devices model performance of actual parts such as resistors, capacitors, and inductors • Nonlinear resistors, conductors, capacitors, and inductors as well as lossless and lossy transmission lines • Shared process models • Powerful Device Editor with integrated Symbol Editor • Unlimited user-defined parameterized sub-circuit models • Create a part from any circuit and package it as a reusable database device • Import and manage external parts libraries • Should have a Data Visualizer • Extensive graphing utilities with complete control over all aspects of the graph • Real and complex data plots and Smith chart • Live digital timing diagrams during live digital circuit simulations • Circuit visualization/animation displays the actual current flow through a circuit and relative voltage relationships by varying the wires' display color. • Cross probing interactively updates the graph as you add or move the probes around the circuit. • Simulation data update on virtual instruments or via circuit animation on the schematic during live in response to live circuit parameter variations • Should be provided with minimum 20 sample experiments in manual
2	**DSP TRAINER KIT**	• The kit should feature the TMS320C6745 DSP or Equivalent , a 375 MHz device delivering up to 3648 million instructions per second (MIPs) and 2736 MFLOPS • Should have On board clock generator • This Kit should have a White noise generator of Amplitude 0 ~ 5Vpp with Signal and noise adder on board • On Board 4*4 LED matrix, 20*2 character LCD

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		display • 7 segment displays should be available on the Kit. • JTAG supported via USB programmable cable to be provided. • TLV320AIC23B or equivalent programmable stereo codec and expansion for port connector for plug-in modules should be provided • Should have facility for 8 DIP switches for inputs and 8 LED indication for output • Should be compatible with Code Composer Studio to write programs and implement on the DSP Chip. All Source Codes for the experiments should be provided on a CD.
3	**DIGITAL COMMUNICATION SYSTEM CONSISTING OF:** a. Basic Digital Communication Training System b. Advance Digital Communication System c. GFSK/GMSK Modulator & Demodulator d. Basic Software Defined Radio System	The Digital Communication System should consist of the Following **a. Basic Digital Communication Training System** Digital Communication System should be a single board system based on VLSI technology for the study of basic digital communication techniques. The Board should have various test points for the students to view intermediate signals on an Oscilloscope. It should be accompanied with a Learning Resource Software consisting of Animations explaining various Digital Modulation Techniques like Sampling, PCM, ASK,FSK,PSK etc and Experiments for the Students to understand the basic concepts of Digital Communication. **Specifications:** Clock & Signal generation section: • sine wave: ▪ Fixed Frequency : 250Hz, 500Hz, 1 KHz, 2khz ▪ Variable Frequency : 1Hz to 30Hz, 0 - 2 Vpp • Sampling clock: ▪ Frequency : 2 KHz, 4 KHz, 8 KHz, 16 KHz, 32 KHz, 64 KHz, 128 KHz ▪ Duty Cycle : 10 - 90% Selectable in steps of 10% ▪ D.C. Signal : 0 - 5 V ▪ Tx Clock Frequency : 240 KHz Fast Mode • Tx Frame Frequency : 8 KHz • Carrier Sine Waves : 500 KHz (0 deg), 1 MHz (0 deg), 1 MHz(180 deg) • Data Pattern : 8 bit variable NRZ-L pattern • PRBS generator : 14 bit Transmitter Section: • Analog signal sampling: Sample & Hold ,Natural Sampling ,Flat-top Sampling • 4-Channel Analog Time Division Multiplexing

SR NO	Item Name	Specification
		• Odd, Even Parity & Hamming Code Generator • Pulse Code Modulation • Data Encoding NRZ(L), NRZ(M), NRZ(S), Bi-phase (Manchester), Bi-phase (Mark), Bi-phase (Space), URZ, Alternate Mark Inversion (AMI), Unipolar to Bipolar & Bipolar to Unipolar • ASK, FSK, PSK Modulation • Delta / Adaptive Delta /Sigma Delta / CVSD Modulation • PAM / PPM / PWM Modulation • Audio Preamplifier with microphone interface. Receiver Section: • 2nd order and 4th order Low Pass Butterworth Filter • 4-Channel Time Division De-multiplexing • Odd, Even Parity & Hamming Code Recovery • Pulse Code Demodulation • Data Decoding NRZ(L), NRZ(M), NRZ(S), Biphase (Manchester), Biphase (Mark),Biphase (Space), URZ, • Alternate Mark Inversion (AMI) • ASK, FSK, PSK Demodulation • Delta / Adaptive Delta / Sigma Delta / CVSD Demodulation • PAM / PPM / PWM Demodulation • Audio Amplifier with headphone / speaker interface **b. Advance Digital Communication System** Advanced Digital Communication System should be a single board system based on VLSI technology for the study of various digital communication techniques. The Board should have various test points for the students to view intermediate signals on an Oscilloscope. It should be accompanied with a Learning Resource Software consisting of Animations explaining various Digital Modulation Techniques like QPSK Modulation / Demodulation, DQPSK Modulation and Demodulation, ADPCM, QAM etc and Experiments for the Students to understand the basic concepts of Digital Communication **Specifications:** Clock & Signal generation: • On-board 500Hz sine wave with amplitude 0 to 4V. • On-board Synchronized Sine wave of 512 KHz (0°, 90°, 180° and 270°). • On-board 24 bit variable data pattern (8 bit, 16 bit & 24 bit selectable @ 256 KHz). • 16 bit switch selectable PRBS generator. • White noise source with amplitude 0 to 2Vpp. • Transmitter clocks: 16KHz, 32KHz, 64 KHz, 128 KHz, 256 KHz , 512 KHz & 1.024MHz.

SR NO	Item Name	Specification
		Transmitter section: • Data encoding: ▪ Differential encoder ▪ Di-bit encoder ▪ Tri-bit encoder ▪ Scrambler Modulation Techniques: • BPSK, DPSK & DEPSK modulation. • QPSK & DQPSK modulation. • QAM & DQAM modulation. • DPCM & ADPCM modulation. • Pulse Amplitude Modulation. Coding and Decoding Technique: • Error bit adder & inter symbol interference. • Bit error rate measurement. (ber) • Study of eye pattern. • Quantization error. • 8 BIT ADC. Receiver section: • Data Decoding: ▪ Differential decoder ▪ Di-bit decoder ▪ Tri-bit decoder ▪ BPSK, DPSK & DEPSK demodulation ▪ QPSK & DQPSK demodulation ▪ QAM & DQAM demodulation ▪ DPCM & ADPCM demodulation Constellation diagrams: Transmission & Reception of Band limited Pulse train in base band digital transmission system. Transmitter & receiver filter with selectable switch of five different bands. Data extraction & reception of band limited pulse train in base band digital transmission system. Low pass Butterworth filters. c. **GFSK/GMSK Modulator & Demodulator** GFSK / GMSK Modulator / Demodulator Kit should be VLSI based design. It should consist of separate component and operational area. It should support modular organization of circuit functions. It should comprise of test points to access signals at every stage of circuit operation. Specifications: Data simulator:On – board variable NRZ-L pattern, Crystal oscillator : 32.768MHz Data clock : 256 KHz, Data encoding : NRZ (L) On board carrier sine waves: HIGH and LOW carrier frequency Modulation index : 0.5 for GMSK, Gaussian filter bt

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		product : 0.3 Carrier modulation : GFSK, GMSK, Carrier demodulation : GFSK, GMSK Data decoding : NRZ (L) Intermediate signal: Provision for observing intermediate signals: Inter Connection : 2mm banana socket,□ Power Supply : +12V, -12V,+5V, GND Test points : 20 **d. Basic Software Defined Radio System** This experimental hardware should cover 70MHz – 6 GHz with integrated RFIC technology, a Spartan6 FPGA, and USB 3.0 connectivity. This new platform should enable experimentation with wide range of applications including FM and TV broadcast, cellular, Wi-Fi, ISM, and more. TheBasic SDR kits should have one receive and one transmit channel. With this kit, users should be able to develop their GNU Radio applications. Application Development with the SDR Kit: This kit should be supported by an open-source, cross-platform driver that can run on Windows, Linux, It should provide a common API, which is used by several software frameworks, such as GNU Radio. Features: • RF Coverage from 70 MHz to 6 GHz RF • GNU Radio and open DTS support through the open source USRP Hardware Driver • USB 3.0 High speed interface (Compatible with USB 2.0) • Flexible rate 12 bit ADC/DAC SDR Kits: • 1TX, 1 RX, Half or Full Duplex • Xilinx Spartan 6 XC6SLX75 FPGA • Up to 56 MHz of real-time bandwidth Specifications: • Power: DC Input : 6V • Conversion Performance and Clocks ADC Sample Rate (max) : 61.44MS/s ADC Resolution : 12bits ADC Wideband SFDR : 78dBc DAC Sample Rate (max) : 61.44MS/s DAC Resolution : 12bits Host Sample Rate (16b) : 61.44MS/s W/ GPSDO Reference : 0.01ppb • RF Performance(single channel)

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		SSB/LO Suppression : -35/50dBc 3.5 GHz : 1.0deg RMS 6 GHz : 1.5deg RMS Power Output : >10dBm IIP3 (@ typ NF) : -20dBm Receive Noise Figure : <8dB Deliverables: Basic SDR Kits, USB Cable, Power Adaptor, Log periodic Antennas frequency Band 850MHzto 6 Ghz: 2nos • Software on Bootable USB memory driver consisting of : Ubuntu 12.10 (32 - bit),GNU Radio (3.6.4) & GNU Radio Companion,USRP Hardware Driver (UHD) Software (3.5.1git), Source Codes of Sample Applications,SDR Environment Updater Source code and generated documentation to be included
4	**ANALOG COMMUNCATION TRAINING SYSTEM** a. Amplitude Modulation Transmitter Kit With eManual b. Amplitude Demodulation Receiver Kit with eManual c. Frequency Modulation Transmitter Kit with eManual d. Frequency Demodulation Receiver Kit with eManual e. Noise Power Spectral Density Measurement Kit f. FDM Transmitter / Receiver Kit g. Filter /Noise and Audio Amplifier Kit h. Fourier Synthesis Kit	The Analog Communication Training System should consist of the following modules **a. AMPLITUDE MODULATION TRANSMITTER KIT with e-Manual** **TECHNICAL SPECIFICATIONS:** Audio Oscillator : Frequency 100Hz to 10 KHz Sine wave generator : Amplitude 0 to 2 Vpp Audio Input : Audio preamplifier with microphone input. **Voltage Controlled Oscillator (VCO)** Output Signal : Sine wave Frequency Range :1) 400 KHz to 500KHz 2) 400 KHz to 1500 KHz **AM/DSB/SSB/Modulator** Modulation : Amplitude Modulation,Double Side band,Single side band Carrier input : 1-1000 KHz **Ceramic Filter** Center Frequency : 455KHz **Output Amplifier** : Gain adjustable connected to cable or antenna **Antenna** : MW Coil. **Switch Faults** : 4 Switch Faults should be provided **b. AMPLITUDE DEMODULATION RECEIVER KIT with emanual** **TECHNICAL SPECIFICATIONS:** **Superheterodyne Receiver:** Frequency Range : 400KHz to 1.5MHz.

SR NO	Item Name	Specification
		Intermediate Frequency : 455KHz. Output IF Frequency : 455KHz adjustable. RF amplifier with variable gain. Mixer (Frequency Converter). **Voltage Controlled Oscillator:** Output Signal : Sine wave for local oscillator input. Frequency : From 400KHz to 1500KHz. Amplitude : Adjustable from 0 to 2Vp-p. Output Impedance : 50 Ohm. **1st IF and 2nd IF Amplifier:** Central Frequency . 455KHz. **Diode Envelope Detector:** Detection of the positive and negative envelope with variable RC filter DSB. **Product Detector:** Operating Frequency : Adjustable from 400KHz to 500KHz SSB. **Receiving Media:** MW Coil Antenna and via cable. **Switch Faults:** 4 Switch Faults should be provided on board to study different effects on circuit. **c. FREQUENCY MODULATION TRANSMITTER KIT with eManual** **TECHNICAL SPECIFICATIONS:** **Synchronous Function Generator:** Waveforms : Sine, Triangular, Square Frequency Range : 1) 100Hz to 1KHz 2) 1 KHz to 10 KHz **FM Modulators** : 2 Nos. Varactor Modulator with carrier frequency adjustment **Mixer (Frequency Converter):** Dual gate MOSFET Inputs : Local oscillator and RF Signal. Output Frequency : 455 KHz adjustable **Switch Faults** : 4 Switch Faults should be provided on board **d. FREQUENCY DEMODULATION RECEIVER KIT with eManual – 3 Nos** **TECHNICAL SPECIFICATIONS:**

SR NO	Item Name	Specification
		Foster-Seely Detector: Operating frequency : Adjustable from 400KHz to 500KHz. **Ratio Discriminator Detector:** Operating frequency : Adjustable from 400KHz to 500KHz. **Phase Lock Loop Detector:** Operating frequency : Adjustable from 400KHz to 500KHz. **Phase Detector And FM Quadrature Detector:** Operating frequency : Adjustable from 400KHz to 500KHz. **Amplitude Limiter:** Operating frequency : 455KHz. **Low Pass Filter:** 4TH Order Butterworth Filter. **Switch Faults:** 4 Switch Faults should be provided on board **e. NOISE POWER SPECTRAL DENSITY MEASUREMENT KIT** SPECIFICATIONS Clock generator Frequency . 2MHz Onboard signal Sine wave Frequency . 1KHz ~ 10KHz Noise generator Pseudo random noise source • Number of bits : 32-bit • Output amplitude : 0 ~ 1V • Noise bandwidth : 2MHz Signal attenuator and adder • Adjustable from 0 to the maximum of input value signal + noise adder stage Low pass filter 4th Order Butterworth filter Power meter and display • Input signal amplitude : 0Vpp ~ 2Vpp • Timer : 1 ~ 15 seconds • Display : 2 digits seven segment Switch faults 4 switch faults are provided on board to study different effects on circuit **f. FDM Transmitter / Receiver Kit** • It should provide On-board clock generator. • Carrier generator range should be 1KHz ~ 20KHz and 1KHz ~ 30KHz with adjustable amplitude of 0Vpp ~ 2Vpp and Pilot carrier with 256KHz frequency It should support High frequency transmission using DSB with

SR NO	Item Name	Specification
		Frequency division multiplexing • It should provide 2 channel FDM communication system • DSB AM modulation and demodulation should be supported • It should perform Amplitude demodulation of DSB at Receiver • It should consist of Pass band Filter 1 and 3 frequency range 8 ~12KHz with f_C10KHz filter 2 and 4 frequency range 18KHz ~ 22KHz with f_C 20KHz • It should have 4thorder Butterworth low pass filters • 8 switch faults are provided on-board to study different effects on circuit • 2mm banana socket should be provided for Interconnection • 25 test points are provided to observe various intermediate signals • It should have a Fixed Power supply of, +5V and GND and a Fixed Power supply of +12V, -12V. **g. Filter /Noise and Audio Amplifier Kit** White noise source generator with adjustable Output amplitude from 0Vp-p to 3Vpp should be provided. It should consist of an Adjustable Signal attenuation network from 0 to the maximum of input value signal + noise adder stage It should have Audio amplifier with loud speaker of Output power 0.5W and Speaker of 8□, 0.3W • It should consist of High pass filter with 3.4KHz cut off frequency • It should contain Band pass filter Frequency range from 7KHz to 13KHz • It should contain Band reject filter Frequency range from 7KHz to 13KHz • It should consist of Matched T and π , high pass, band pass and band reject filters • Matched filter for□□□section 20KHz as cut off frequency should be provided. • Matched filter for T section 20KHz as cut off frequency should be provided. • It should support Input Voltage and Output Voltage from 0Vp-p to 2Vpp • 4 switch faults are provided on board to study different effects on circuit 2mm banana socket for Interconnection is to be given. 24 test points are provided on board to observe various intermediate signals It should consist of Fixed Power supply of, +5V and GND It should consist of Fixed Power supply of +12V, -12V

SR NO	Item Name	Specification
		h. FOURIER SYNTHESIS KIT It should support Signal synthesis by summing 10 harmonics Each harmonic selectable with +sin, -sin, +cos, -cos value should be supported. Square, triangle, ramp, pulse, rectified sine, AM and other waves should be available. It should perform Spectrum analysis of the signal using ACT-01 and ACT -02 for Wave-form generation Frequency of the fundamentals 10 KHz with quartz control is to be included Frequency of the harmonics is 20KHz, 30KHz, 40KHz, 50KHz, 60KHz, 70KHz, 80KHz, 90KHz, 100KHz, should be included. It should carry Selectable Phase of each sine wave 0° (sin) 90° (cos), 180° (-sin), 270° (-cos) Adjustable amplitude of each sine-wave on 2 ranges from 0Vpp to 1Vpp or from 0Vpp to10Vpp should be provided. Indication of the presence of each harmonic via LED should be provided. It should provide Adjustable Amplitude of the DC component from -10V to +10V Adder stage with 11 inputs should be included Fixed Power supply of, +5V and GND should be provided. Fixed Power supply of +12V, -12V should be provided

FORMAT FOR QUOTATION SUBMISSION
(In letterhead of the supplier with seal)

Date: _____

To:_____
_____

Sl. No.	Description of goods \ (with full Specifications)	Qty.	Unit	Quoted Unit rate in Rs. (Including Ex-Factory price, excise duty, packing and forwarding, transportation, insurance, other local costs incidental to delivery and warranty/ guaranty commitments)	Total Price (A)	Sales tax and other taxes payable	
						In %	In figures (B)
Total Cost							

Gross Total Cost (A+B): Rs. _____

We agree to supply the above goods in accordance with the technical specifications for a total contract price of Rs. ———————— (Amount in figures) (Rupees ———— ————amount in words) within the period specified in the Invitation for Quotations.

We confirm that the normal commercial warranty/ guarantee of ———————— months shall apply to the offered items and we also confirm to agree with terms and conditions as mentioned in the Invitation Letter.

We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in bribery.

Signature of Supplier
Name: _____
Address: _____
Contact No. _____