

INVITATION FOR QUOTATION

TEQIP-III/2018/gwec/Shopping/7

26-July-2018

To,

Sub: Invitation for Quotations for supply of Goods for Communication Lab (ECE)

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	Brief Description	Quantity	Delivery Period(In days)	Place of Delivery	Installation Requirement (if any)
1	ASK, FSK, BPSK, DBPSK Modulator & Demodulator	4	30	Electronics and Communication Department	Yes
2	Block Codes	2	30	Electronics and Communication Department	Yes
3	Carrier Demodulation and Data Reformatting Receiver	2	30	Electronics and Communication Department	Yes
4	Data Formatting and Carrier Modulation Transmitter	2	30	Electronics and Communication Department	Yes
5	Delta, Adaptive Delta, Sigma Delta Modulator & Demodulator	2	30	Electronics and Communication Department	Yes



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6	DSB-AM Modulation & Demodulation	3	30	Electronics and Communication Department	Yes
7	Error Detection and Correction Cyclic Codes	2	30	Electronics and Communication Department	Yes
8	Four Channel Analog TDM System	3	30	Electronics and Communication Department	Yes
9	Fourier Synthesis Training System	3	30	Electronics and Communication Department	Yes
10	Frequency Division Multiplexer / Demultiplexer	2	30	Electronics and Communication Department	Yes
11	Frequency Modulation / Demodulation	3	30	Electronics and Communication Department	Yes
12	MSK Modulator/ Demodulator	2	30	Electronics and Communication Department	Yes
13	PAM-PPM-PWM Modulation- Demodulation Techniques	3	30	Electronics and Communication Department	Yes
14	PCM Generation & Demodulation using CODEC Chip	2	30	Electronics and Communication Department	Yes
15	PCM, DPCM Modulator & Demodulator	2	30	Electronics and Communication Department	Yes



16	QPSK, DQPSK Modulator & Demodulator	2	30	Electronics and Communication Department	Yes
17	Sampling & Reconstruction Technique	2	30	Electronics and Communication Department	Yes
18	Stereo FM Radio Trainer	3	30	Electronics and Communication Department	Yes
19	TDM - PAM Transmitter Receiver	2	30	Electronics and Communication Department	Yes
20	TDM Pulse Code Demodulator and Receiver	2	30	Electronics and Communication Department	Yes
21	TDM Pulse Code Modulation & Transmitter	2	30	Electronics and Communication Department	Yes
22	Transmission Line Trainer	3	30	Electronics and Communication Department	Yes


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, initialing, 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:
- Delivery and Installation - 90% of total cost**
- Satisfactory Acceptance - 10% of total cost**



10. All supplied items are under warranty of **36 months** from the date of successful acceptance of items.
11. You are requested to provide your offer latest by **15:00 hours on 28-Aug-2018**.
12. Detailed specifications of the items are at Annexure I.
13. Training Clause (if any) **Required On Site**
14. Testing/Installation Clause (if any) **Required On Site**
15. Information brochures/ Product catalogue, if any must be accompanied with the quotation clearly indicating the model quoted for.
16. Sealed quotation to be submitted/ delivered at the address mentioned below,
Makhupura, Nasirabad Road, Ajmer -305002
17. We look forward to receiving your quotation and thank you for your interest in this project.
18. Please write lab and package name on envelope.
19. You are requested to provide the company details viz. Firm Registration Certificate , GST Registration Certificate and any other necessary documents duly certified by Chartered Accountant and Notary Public.


(Authorized Signatory)
Principal
Govt. Women's Engineering College
Ajmer



Annexure I

Sr. No	Item Name	Specifications
1	ASK, FSK, BPSK, DBPSK Modulator & Demodulator	<p>ASK / PSK / FSK Modulation and Demodulation Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • VLSI based design • Separate component and operational area • Acrylic cover for component safety • Modular organization of circuit functions • Test points to access signals at every stage of circuit operation • Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <ul style="list-style-type: none"> • Data Simulator : Onboard 8-bit variable NRZ-L Pattern • Crystal Oscillator : 32.768 MHz • Data Clock : 256 KHz • Data format : NRZ (L) • Onboard Carrie Sine : 1 MHz (00), 1MHz (1800), • Waves : 500 KHz (00) • Carrier Modulation : ASK, FSK, PSK • Carrier demodulation : ASK, FSK, PSK • Intermediate signal : During demodulation • Inter connection : 2 mm banana Socket • Power Supply : +12V, -12V, +5V, GND • Switch banks : 1 • Reset Switch : 1 • Test point : 17 <p>EXPERIMENTS</p> <ul style="list-style-type: none"> • Amplitude shift keying modulation and demodulation techniques • Frequency shift keying modulation and demodulation techniques • Phase shift keying modulation and demodulation <p>BPSK/DPSK/DEPSK Modulation /Demodulation Kit</p> <p>SPECIFICATION</p> <p>Data simulator : On-board 8-bit variable NRZ-L pattern</p> <p>Crystal oscillator : 32.768 MHz</p>



		<p>Clock frequency : 256KHz</p> <p>Data encoding : NRZ-L, Differentially encoded NRZ-L</p> <p>On-Board Carrier sine waves:1MHz (0degree) and MHz (180degree)</p> <p>Carrier modulation : BPSK, DPSK, DEPSK</p> <p>Carrier demodulation : BPSK, DPSK, DEPSK</p> <p>Data decoding : NRZ-L, Differentially encoded NRZ-L</p> <p>Intermediate Signal : Provision for observing intermediate signal during demodulation</p> <p>Power supply :+12V,-12V,+5V,GND</p> <p>Test points:18</p> <p>EXPERIMENTS</p> <ul style="list-style-type: none"> • To study carrier modulation and demodulation technique by Binary Phase Shift Keying (BPSK) Method • To study the differential encoding technique for NRZ-L data • To study carrier modulation and demodulation technique by differential Phase Shift Keying (DPSK) Method • To study carrier modulation and demodulation technique by Differential Encoded Phase Shift Keying (DEPSK) Method
2	Block Codes	<p>CRC Encoder / Decoder And MSK Modulation/Demodulation kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • VLSI based design • Separate component and operational area • Acrylic cover for component safety • Modular organization of circuit functions • Test points to access signals at every stage of circuits operation <p>SPECIFICATIONS</p> <p>Clock and signal generation</p> <ul style="list-style-type: none"> • on board synchronized carriers of frequency 256 KHz and 384 KHz • on board 8-bit variable data pattern • data clocks of 256 KHz <p>Transmitter section</p> <ul style="list-style-type: none"> • Data encoding



		<ul style="list-style-type: none"> - Di – bit decoder - CRC decoding <p>Modulation techniques</p> <ul style="list-style-type: none"> • MSK modulation • Provision to add errors in CRC data <p>Receive section</p> <ul style="list-style-type: none"> • Data decoding <ul style="list-style-type: none"> - Di – bit decoder - CRC decoding <p>Demodulation techniques</p> <ul style="list-style-type: none"> • MSK demodulation • Constellation diagrams for MSK <p>EXPERIMENTS</p> <ul style="list-style-type: none"> • Study of MSK modulation and demodulation • Study of constellation diagram for MSK <p>Study of CRC encoder and decoder</p>
3	Carrier Demodulation and Data Reformatting Receiver	<p>Data Conditioning And Reconditioning Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • VLSI based design • Separate component and operational area • Acrylic cove for component safety • Modular organization of circuit functions • Test points to access signals at every stage of circuit operation • Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <p>Data simulator : onboard 8-bit variable NRZ-L pattern</p> <p>Crystal oscillator : 6.40 MHz</p> <p>Data Format : 266 KHz</p> <p>Data conditioning : NRZ (L)</p> <ul style="list-style-type: none"> • NRZ (Level, Mark, Space) • URZ • BIPHASE (Level, Mark, Space) • Unipolar To Bipolar • AMI <p>Data Reconditioning</p> <ul style="list-style-type: none"> • NRZ (Level, Mark, space) • URZ • BIPHASE (Level, Mark, Space) • Bipolar To Unipolar



		<ul style="list-style-type: none"> • AMI <p>Inter connection : 2 Mm Banana Socket</p> <p>Power supply : -12V, +5V, GND.</p> <p>Switch Banks : 1</p> <p>Reset Switch : 1</p> <p>Test Points : 26</p> <p>EXPERIMENTS</p> <p>Experiment no. 1</p> <ul style="list-style-type: none"> • Data conditioning and reconditioning techniques for non-return to zero format <ul style="list-style-type: none"> - NRZ -L - NRZ -M - NRZ -S - UNIPOLAR to BIPOLAR - BIPOLAR to UNIPOLAR <p>Experiment no. 2</p> <ul style="list-style-type: none"> • Data conditioning and reconditioning techniques for phase encoded format <ul style="list-style-type: none"> - BIO -L - BIO -M - BOI -S <p>Experiment no. 3</p> <ul style="list-style-type: none"> • Data conditioning and reconditioning techniques for return to zero format and multilevel binary format <ul style="list-style-type: none"> - URZ RZ-AMI
4	Data Formatting and Carrier Modulation Transmitter	<p>Data Conditioning And Reconditioning Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • VLSI based design • Separate component and operational area • Acrylic cove for component safety • Modular organization of circuit functions • Test points to access signals at every stage of circuit operation • Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <p>Data simulator : onboard 8-bit variable NRZ-L pattern</p> <p>Crystal oscillator : 6.40 MHz</p> <p>Data Format : 266 KHz</p>



		<p>Data conditioning : NRZ (L)</p> <ul style="list-style-type: none"> • NRZ (Level, Mark, Space) • URZ • BIPHASE (Level, Mark, Space) • Unipolar To Bipolar • AMI <p>Data Reconditioning</p> <ul style="list-style-type: none"> • NRZ (Level, Mark, space) • URZ • BIPHASE (Level, Mark, Space) • Bipolar To Unipolar • AMI <p>Inter connection : 2 Mm Banana Socket</p> <p>Power supply : -12V, +5V, GND.</p> <p>Switch Banks : 1</p> <p>Reset Switch : 1</p> <p>Test Points : 26</p> <p>EXPERIMENTS</p> <p>Experiment no. 1</p> <ul style="list-style-type: none"> • Data conditioning and reconditioning techniques for non-return to zero format <ul style="list-style-type: none"> - NRZ -L - NRZ -M - NRZ -S - UNIPOLAR to BIPOLAR - BIPOLAR to UNIPOLAR <p>Experiment no. 2</p> <ul style="list-style-type: none"> • Data conditioning and reconditioning techniques for phase encoded format <ul style="list-style-type: none"> - BIO -L - BIO -M - BOI -S <p>Experiment no. 3</p> <ul style="list-style-type: none"> • Data conditioning and reconditioning techniques for return to zero format and multilevel binary format <ul style="list-style-type: none"> - URZ - RZ-AMI
5	Delta, Adaptive Delta, Sigma Delta Modulator & Demodulator	<p>Delta / Sigma Delta And Adaptive Delta Modulation /Demodulation Kit</p> <p>FEATURES</p>



- Separate component and operational area
- Acrylic cover for component safety
- Modular organization of circuit functions
- Test points to access signals at every stage of circuit operation
- Multimedia base interactive e-manual

SPECIFICATIONS

On – board signals

Sine wave

- Frequency : 250Hz, 500Hz, 1KHz, and 2KHz
- Amplitude : 0 ~ 4Vpp
- DC : 0 ~ 5V

Sampling

- Clock : 8KHz, 16KHz, 32KHz, 64 KHz and 128KHz
- Duty Cycle : 50%

Modulation techniques

- Delta modulation, delta modulation, adaptive delta modulation, CVSD modulation

Companer : μ - law Companer and expander

Voice communication

- Voice link for above modulation techniques using external audio input and output kit (optional)

Low pass butter worth filter

- 2nd order and 4th order low pass butter worth and filter with cut-off frequency of 3.4 KHz

Switch faults

- 8 switch faults are provided on board to study different effects on circuit

Interconnection

- 2 mm banana socket
- Two 4 connectors for audio input/output kit

Test points

- 34 test points are provided to observe various intermediate signals

Power supply

- GND, +5V, +12V, -12V

EXPERIMENTS

- Delta modulation and demodulation
- Slope overload and increased integrator gain



		<ul style="list-style-type: none"> • Sigma delta modulation and demodulation • Adaptive delta modulation CVSD • Compression and expansion • Effect of switch faults <p>Voice communication (optional)</p>
6	DSB-AM Modulation & Demodulation	<p>Amplitude Modulation Transmitter Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • On-board audio oscillator of 100Hz ~ 10KHz frequency • Voltage controlled oscillator of 400KHz ~ 1500KHz frequency • Balanced modulators for DSB/SSB AM generator • Colpit's oscillator of 1 MHz • Audio pre-amplifier • Output amplifier 400KHz ~ 1650KHz • Ceramic filter of 455KHz • Band pass filter at 455KHz with 10KHz bandwidth • On-board antenna • Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <p>Audio oscillator (sine wave generator)</p> <ul style="list-style-type: none"> • Frequency : 100Hz ~ 10KHz • Amplitude : 0 ~ 2Vpp • Audio input : Audio preamplifier with microphone input <p>Voltage controlled oscillator (VCO)</p> <ul style="list-style-type: none"> • Output signal : sine wave • Frequency range : 1) 400KHz ~ 500KHz 2) 400KHz ~ 1500KHz • Amplitude : 0~2Vpp • Output impedance : 50Ω <p>AM/DSB/SSB/modulator</p> <ul style="list-style-type: none"> • Modulation : Amplitude modulation : double side band : Single side band (LSB) • Carrier input : 1 ~ 1000KHz • Modulating input : 1 ~ 100KHz • Carrier null : Adjustable • Output amplitude : Adjustable <p>Ceramic filter</p> <ul style="list-style-type: none"> • Center frequency : 455KHz • Bandwidth : 10 KHz ± 3 KHz



Output amplifier

- Gain adjustable connected to cable or antenna

Antenna

- MW Coil

Switch faults

- 4 switch faults are provided on board to study different effects on circuit

Interconnection

- 2mm banana socket

Power supply

- GND, +5V, +12V, -12V

EXPERIMENTS

- Study of double side band AM generator
- Study of single side band AM generator
- Study of adjustment of transmitter tuned circuits
- Voice transmission with DSB/SSB AM transmission
- Effect of switch faults

Amplitude Demodulation Receiver kit

FEATURES

- Super-heterodyne AM receiver with AGC (400KHz ~ 1500KHz)
- RF amplifier 400KHz ~ 1650KHz
- Local oscillator If 500KHz ~ 2.1MHz frequency
- Beat frequency oscillator from 400~500MHz
- Mixer
- 1st IF and 2nd IF amplifier
- Envelope detector
- Audio amplifier with gain 20dB
- On-board antenna
- Multimedia based interactive e-manual

SPECIFICATIONS

Super heterodyne receiver

- Frequency : 400KHz ~ 1.5MHz
- Intermediate frequency : 455KHz
- Inputs : RF signal
- Output IF frequency : 455KHz adjustable
- IF filter : Dual tune LC
- RF amplifier with variable gain

Mixer (frequency converter)

- Dual Gate MOSFET



	<ul style="list-style-type: none"> • Input RF : Local Oscilloscope and RF • Output frequency : 455Khz adjustable • Band pass filter frequency : 455KHz center frequency
	Voltage controlled oscillator <ul style="list-style-type: none"> • Output signal : Sine wave for local oscillator input • Frequency : From 400 KHz ~ 1500KHz • Amplitude : Adjustable From 0~2Vpp • Output impedance : 50Ω
	1st IF and 2nd IF amplifier <ul style="list-style-type: none"> • Central frequency : 455 KHz • Local impedances : Variable R-L-C • Gain : 40 dB with automatic gain control
	Diode envelope detector <ul style="list-style-type: none"> • Detection of the positive and negative envelope with variable RC filter DSB
	Product detector <ul style="list-style-type: none"> • Operating frequency : Adjustable from 400KHz ~ 500KHz SSB • Input amplitude : 1Vpp
	Audio output <ul style="list-style-type: none"> • Amplifier with speaker • Audio amplifier gain : 20dB
	Receiving media <ul style="list-style-type: none"> • MW coil antenna and via cable
	Switch faults <ul style="list-style-type: none"> • 4 Switch faults are provided on board to study different effects on circuit
	Interconnection <ul style="list-style-type: none"> • 2 mm banana socket
	Power supply <ul style="list-style-type: none"> • GNC, +5V, +12V, -12V
	EXPERIMENTS <ul style="list-style-type: none"> • Study of double sideband AM reception using envelope diode detector • Study of single side band AM reception using product detector



		<ul style="list-style-type: none"> • Study of image frequencies • Study of adjustment of receiver tuned circuits • Voice reception using DSB/SSB AM receiver (super heterodyne receiver) <p>Effects of switch faults</p>
7	Error Detection and Correction Cyclic Codes	<p>CRC Encoder / Decoder And MSK Modulation/Demodulation kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • VLSI based design • Separate component and operational area • Acrylic cover for component safety • Modular organization of circuit functions • Test points to access signals at every stage of circuits operation <p>SPECIFICATIONS</p> <p>Clock and signal generation</p> <ul style="list-style-type: none"> • on board synchronized carriers of frequency 256 KHz and 384 KHz • on board 8-bit variable data pattern • data clocks of 256 KHz <p>Transmitter section</p> <ul style="list-style-type: none"> • Data encoding <ul style="list-style-type: none"> - Di – bit decoder - CRC decoding <p>Modulation techniques</p> <ul style="list-style-type: none"> • MSK modulation • Provision to add errors in CRC data <p>Receive section</p> <ul style="list-style-type: none"> • Data decoding <ul style="list-style-type: none"> - Di – bit decoder - CRC decoding <p>Demodulation techniques</p> <ul style="list-style-type: none"> • MSK demodulation • Constellation diagrams for MSK <p>EXPERIMENTS</p> <ul style="list-style-type: none"> • Study of MSK modulation and demodulation • Study of constellation diagram for MSK <p>Study of CRC encoder and decoder</p>
8	Four Channel Analog TDM System	<p>PAM Time Division Multiplexing /Demultiplexing Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • Separate component and operational area



- Acrylic cover for component safety
- Modular organization of circuit functions
- Test points to access signals at every stage of circuit operation
- Multimedia based interactive e-manual

SPECIFICATIONS

On board signals

Sine waves

- Frequency : 250Hz, 500Hz, 1KHz, 2KHz
- Amplitude : 0 ~ 5Vpp
- DC signal : 0 ~ -5V

Input channels : 4

Multiplexing : time division multiplexing

- Sampling rate : 32 KHz

Modulation : pulse amplitude modulation

Receiver clock

- Phase lock loop generates receiver clock and channel information

Low pass filter

- 4th order butter worth filters (3.4 KHz cut off)

Switch faults

- 8 switch faults are provided on board to study different effects on circuit

Interconnection

- 2 mm banana socket
- Two 4 pin connector for audio input/output kit

Test Points

- 39 test points are provided to observe various intermediate signals

Power supply

- GND, +5V, +12V, -12V

EXPERIMENTS

- Principles of time division multiplexing
- Study of TDM pulse amplitude modulation/demodulation
- Study of TDM Pulse amplitude modulation/demodulation with channel identification information
- To study the use of a threshold level comparator and phase locked loop circuitry



		<ul style="list-style-type: none"> • Effect of switch faults <p>Voice communication (optional)</p>
9	Fourier Synthesis Training System	<p>Fourier Synthesis kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • Signal synthesis by summing 10 harmonics • Each harmonic selectable with +sin, sin, +cos, -cos value • Square, triangle, ramp, pulse, rectified sine, AM and other <p>Wave –from generation</p> <ul style="list-style-type: none"> • Spectrum analysis of the signal using ACT-01 and ACT-02 • Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <p>Frequency of fundamentals</p> <ul style="list-style-type: none"> • 10 KHz with quartz control <p>Frequency of the harmonic</p> <ul style="list-style-type: none"> • 20KHz with, 30KHz, 40KHz, 50KHz, 60KHz, 70KHz, 80KHz, 90KHz, 100KHz <p>Phase of each sine wave</p> <ul style="list-style-type: none"> • Selectable 0° (sin), 90° (cos), 180° (-sin), 270° (-cos) <p>Amplitude of each sine – wave</p> <ul style="list-style-type: none"> • Adjustable on 2 ranges from 0 ~ 1Vpp or from 0 ~ 10Vpp • Indication of the presence of each harmonic : via LED <p>Amplitude of the DC component</p> <ul style="list-style-type: none"> • Adjustable from -10V ~ +10V <p>Adder stage with 11 inputs power supply</p> <ul style="list-style-type: none"> • GND, +12V, -12V, +5V <p>EXPERIMENTS</p> <ul style="list-style-type: none"> • To study square wave synthesis • To study triangular wave synthesis • To study saw-tooth wave synthesis <p>To study AM wave synthesis</p>
10	Frequency Division Multiplexer /Demultiplexer	<p>FDM Transmitter/Receiver Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • Onboard clock generator • Carrier generator 1 KHz ~ 30KHz • Pilot carrier 256KHz • 2 channel FDM communication system



- DSB AM modulator and demodulator
- Band pass filters 9 ~ 11 KHz and 16 ~ 20 KHz
- 4th Order Butterworth low pass filters
- Multimedia based interactive e-manual

SPECIFICATIONS

Carrier generator

- Sub carrier : 1KHz ~ 20KHz and 1 KHz ~ 30KHz with adjustable amplitude of 0 ~ 2Vpp
- Pilot carrier : 256 KHz
- Transmitter : High frequency transmission using DSB
- Multiplexing : frequency division multiplexing
- Channel : 02

Band pass filter

- Pass band : Filter 1 and 3 frequency range 8 ~ 12KHz with fc 10 KHz filter 2 and 4 frequency range 18 ~ 22 KHz with fc 20KHz

AM/DM modulator

- Modulation : Amplitude modulation double side band
- Receiver : Amplitude demodulation of DSB
- De-multiplexing : Frequency division de-multiplexing

Low pass filter

- 4 order butter worth filter

Switch faults

- 8 switch faults are provided on board to study different effects on circuit

Interconnection

- 2 mm banana socket

Test points

- 16 test points are provided on board to observe intermediate signals

Power supply

- GND, +5V, +12V, -12V

EXPERIMENTS

- To study frequency response of band pass filter
- Study of DSB modulation
- To study the operation of frequency division demultiplexing
- Study of DSB demodulation



		<ul style="list-style-type: none"> • To study the operation frequency division demultiplexing • To study the effects of out of band signaling • To study effect of switch faults <p>To study voice communication through FDM (optional)</p>
11	Frequency Modulation / Demodulation	<p>Frequency Modulation Transmitter Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • On-board synchronous function generator of 1Hz ~ 100 KHz frequency • FM modulation (Quantity 3) • Works at center frequency of 455 KHz • Varactor modulator • Reactance modulator • FM via PM • Pre-emphasis • PM modulator • Mixer • Audio pre-amplifier with 20 dB gain • Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <p>Synchronous function generator</p> <ul style="list-style-type: none"> • Waveforms : 400KHz ~ 1.5MHz • Amplitude : 0 ~ 2Vpp variable • Frequency Range : 1) 100Hz ~ 1 KHz 2) 1 KHz ~ 10KHz <p>Audio input</p> <ul style="list-style-type: none"> • Audio preamplifier with microphone <p>Fm modulators</p> <ul style="list-style-type: none"> • Varactor modulator with carrier frequency adjustment Fm via PM • Operating frequency ; Adjustable from 400KHz ~ 500KHz • Input amplitude : 0.1Vpp with integration circuit for indirect frequency modulation <p>PM modulator</p> <ul style="list-style-type: none"> • Operating frequency : Adjustable from 400 KHz ~ 500 KHz • Input amplitude : 0.5 Vpp with integration circuit for indirect frequency modulation <p>Mixer (frequency converter)</p> <ul style="list-style-type: none"> • Dual gate MOSFET inputs . Local oscillator and RF



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signal

- Output IF frequency : 455KHz adjustable
- IF filter : Dual tune LC
- Transmitter output : 455 KHz frequency

Switch faults

- 4 switch faults are provided on board to study different effects on circuit

Interconnection

- 2mm banana socket

Test points

- 29 test points are provided on board to observe effects on circuit

Power supply

- GND, +5, +12, -12V
(Dual output terminals)

EXPERIMENTS

- Study of varactor modulator
- Study of frequency modulation via phase modulator
- Study phase modulation
- Voice transmission on various modulation methods
- Effect of switch faults

Frequency Demodulation Receiver Kit

FEATURES

- Frequency demodulator
 - Foster seelay detector
 - Ratio detector
 - Phase locked loop detector
 - Quadrature detector
 - Detuned resonance detector
- De-emphasis
- Amplitude limiter
- Low pass filter
- Audio amplifier
- Multimedia based interactive e-manual

SPECIFICATIONS

Clock generator

- Frequency : 2 MHz

Onboard signal

- Sine wave



		<ul style="list-style-type: none"> • Frequency : 1 ~ 10KHz • Amplitude : 0 ~ 2Vpp <p>Noise generator pseudo random noise source</p> <ul style="list-style-type: none"> • Number of bits : 32 – bit • Output amplitude : 0 ~ 1V • Noise bandwidth : 2MHz <p>Signal attenuator and adder</p> <ul style="list-style-type: none"> • Adjustable from 0 to the maximum of input value single + noise adder stage <p>Low pass filter</p> <ul style="list-style-type: none"> • 4th order Butterworth filter • Cut-off frequency : 3.4KHz <p>Power meter and display</p> <ul style="list-style-type: none"> • Input signal amplitude : 0 ~ 2Vpp • Timer : 1 ~ 15 seconds • Display : 2 digits seven segment <p>Switch faults</p> <ul style="list-style-type: none"> • 4 Switch faults are provided on board to study different effects on circuit <p>Interconnection</p> <ul style="list-style-type: none"> • 2 mm banana socket <p>Test points</p> <ul style="list-style-type: none"> • 16 test points are provided on board to observe intermediate signals <p>Power supply</p> <ul style="list-style-type: none"> • GND, +5V, +12V, -12V <p>EXPERIMENTS</p> <ul style="list-style-type: none"> • To observe the effect of noise on various analog systems • To calculate signal to noise ratio • To calculate noise figure • To calculate noise power and noise power spectral density • To study the effects of low pass filter on noisy signal <p>To study the effects of switch faults</p>
12	MSK Modulator/ Demodulator	<p>CRC Encoder / Decoder And MSK Modulation/Demodulation kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • VLSI based design • Separate component and operational area



		<ul style="list-style-type: none"> • Acrylic cover for component safety • Modular organization of circuit functions • Test points to access signals at every stage of circuits operation <p>SPECIFICATIONS</p> <p>Clock and signal generation</p> <ul style="list-style-type: none"> • on board synchronized carriers of frequency 256 KHz and 384 KHz • on board 8-bit variable data pattern • data clocks of 256 KHz <p>Transmitter section</p> <ul style="list-style-type: none"> • Data encoding <ul style="list-style-type: none"> - Di – bit decoder - CRC decoding <p>Modulation techniques</p> <ul style="list-style-type: none"> • MSK modulation • Provision to add errors in CRC data <p>Receive section</p> <ul style="list-style-type: none"> • Data decoding <ul style="list-style-type: none"> - Di – bit decoder - CRC decoding <p>Demodulation techniques</p> <ul style="list-style-type: none"> • MSK demodulation • Constellation diagrams for MSK <p>EXPERIMENTS</p> <ul style="list-style-type: none"> • Study of MSK modulation and demodulation • Study of constellation diagram for MSK <p>Study of CRC encoder and decoder</p>
13	PAM-PPM-PWM Modulation- Demodulation Techniques	<p>Pulse amplitude / pulse width/ Pulse position modulation/ Demodulation kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • Separate component and operational area • Acrylic cover for component safety • Modular organization of circuit functions • Test points to access signals at every stage of circuit operation • Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <p>On-board signals</p> <p>Sine wave</p> <ul style="list-style-type: none"> • Variable frequency : 1Hz ~30Kz



		<ul style="list-style-type: none"> • Amplitude : 0 ~ 2Vpp • Fixed Frequency : 500Hz and 1KHz • Amplitude : 0 ~ 4Vpp <p>Sampling</p> <ul style="list-style-type: none"> • Internal sampling clock : 8KHz and 16KHz • Duty cycle : 50% <p>Modulation techniques</p> <ul style="list-style-type: none"> • Pulse amplitude modulation (with variable clock 8KHz, 16KHz) • Pulse width modulation (with variable clock 4KHz, 8KHz, 16KHz, 32KHz) • Pulse position modulation (with variable clock 4KHz, 8KHz, 16KHz, 32KHz) <p>Voice communication</p> <ul style="list-style-type: none"> • Voice link for above modulation techniques using external audio input/ output kit (optional) <p>Switch faults</p> <ul style="list-style-type: none"> • 8 Switch faults are provided on board to study different effects on circuit <p>Interconnection</p> <ul style="list-style-type: none"> • 2 mm banana socket • Two 4 pin connector for audio input/output kit <p>Two points</p> <ul style="list-style-type: none"> • 29 test points are provided on board to observe intermediate signals <p>Power supply</p> <ul style="list-style-type: none"> • GND, +5V, +12V, -12V <p>EXPERIMENTS</p> <ul style="list-style-type: none"> • Principles of pulse modulation • Pulse amplitude modulation • Pulse width modulation • Effect of switch faults <p>Voice communication (optional)</p>
14	PCM Generation & Demodulation using CODEC Chip	<p>Pulse code Modulation Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • Separate component and operational area • Acrylic cover for component safety • Modular organization of circuit functions • Test points to access signals at every stage of circuit operation • LED indication of digital patterns



- Multimedia based interactive e-manual

SPECIFICATIONS

Input channels

- 2 channel time division multiplexed pulse code modulation receiver

Receive clock

- Generated by phase lock loop

Parity check facility

- Even, odd, hamming

Error correction

- Hamming code

Low pass filter

- Two 4th order butterworth filter, 3.4 KHz (cut – off)

Switch faults

- 4 switch faults are provided on board to study different effects on circuit

Interconnection

- 2 mm banana socket
- 4 pin connector for audio output kit

Test points

- 25 test points are provided to observe various intermediate signals

Power supply

- GND, +5V, +12V, -12V

EXPERIMENTS

- Principles of pulse code demodulation techniques
- Study of 2 channel time division demultiplexing and pulse code demodulation
- Study principle of digital to analog converter
- Study of pseudo random bit sequence generation
- Study of error control coding technique using odd parity even parity and hamming parity
- Synchronization techniques
 - Bit synchronization
 - Frame synchronization
- Effect of switch faults
- Voice communication (optional)

Pulse code DeModulation Kit

FEATURES

- Separate component and operational area
- Acrylic cover for component safety
- Modular organization of circuit functions



		<ul style="list-style-type: none"> • Test points to access signals at every stage of circuit operation • LED indication of digital patterns • Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <ul style="list-style-type: none"> • Input channels • 2 channel time division multiplexed pulse code modulation receiver • Receive clock • Generated by phase lock loop • Parity check facility • Even, odd, hamming • Error correction • Hamming code <p>Low pass filter</p> <ul style="list-style-type: none"> • Two 4th order butterworth filter, 3.4 KHz (cut – off) <p>Switch faults</p> <ul style="list-style-type: none"> • 4 switch faults are provided on board to study different effects on circuit <p>Interconnection</p> <ul style="list-style-type: none"> • 2 mm banana socket • 4 pin connector for audio output kit <p>Test points</p> <ul style="list-style-type: none"> • 25 test points are provided to observe various intermediate signals <p>Power supply</p> <ul style="list-style-type: none"> • GND, +5V, +12V, -12V <p>EXPERIMENTS</p> <ul style="list-style-type: none"> • Principles of pulse code demodulation techniques • Study of 2 channel time division demultiplexing and pulse code demodulation • Study principle of digital to analog converter • Study of pseudo random bit sequence generation • Study of error control coding technique using odd parity even parity and hamming parity • Synchronization techniques • Bit synchronization • Frame synchronization • Effect of switch faults <p>Voice communication (optional)</p>
15	PCM, DPCM Modulator & Demodulator	<p>Pulse code Modulation Kit</p> <p>FEATURES</p>



- Separate component and operational area
- Acrylic cover for component safety
- Modular organization of circuit functions
- Test points to access signals at every stage of circuit operation
- LED indication of digital patterns
- Multimedia based interactive e-manual

SPECIFICATIONS

Input channels

- 2 channel time division multiplexed pulse code modulation receiver

Receive clock

- Generated by phase lock loop

Parity check facility

- Even, odd, hamming

Error correction

- Hamming code

Low pass filter

- Two 4th order butterworth filter, 3.4 KHz (cut – off)

Switch faults

- 4 switch faults are provided on board to study different effects on circuit

Interconnection

- 2 mm banana socket
- 4 pin connector for audio output kit

Test points

- 25 test points are provided to observe various intermediate signals

Power supply

- GND, +5V, +12V, -12V

EXPERIMENTS

- Principles of pulse code demodulation techniques
- Study of 2 channel time division demultiplexing and pulse code demodulation
- Study principle of digital to analog converter
- Study of pseudo random bit sequence generation
- Study of error control coding technique using odd parity even parity and hamming parity
- Synchronization techniques
 - Bit synchronization
 - Frame synchronization
- Effect of switch faults



- Voice communication (optional)

Pulse code Demodulation Kit

FEATURES

- Separate component and operational area
- Acrylic cover for component safety
- Modular organization of circuit functions
- Test points to access signals at every stage of circuit operation
- LED indication of digital patterns
- Multimedia based interactive e-manual

SPECIFICATIONS

- Input channels
- 2 channel time division multiplexed pulse code modulation receiver
- Receive clock
- Generated by phase lock loop
- Parity check facility
- Even, odd, hamming
- Error correction
- Hamming code

Low pass filter

- Two 4th order butterworth filter, 3.4 KHz (cut – off)

Switch faults

- 4 switch faults are provided on board to study different effects on circuit

Interconnection

- 2 mm banana socket
- 4 pin connector for audio output kit

Test points

- 25 test points are provided to observe various intermediate signals

Power supply

- GND, +5V, +12V, -12V

EXPERIMENTS

- Principles of pulse code demodulation techniques
- Study of 2 channel time division demultiplexing and pulse code demodulation
- Study principle of digital to analog converter
- Study of pseudo random bit sequence generation
- Study of error control coding technique using odd parity even parity and hamming parity
- Synchronization techniques



- Bit synchronization
- Frame synchronization
- Effect of switch faults

Voice communication (optional)

DPCM/ADPCM Modulation/Demodulation Kit

FEATURES

- Separate component and operational area
- Acrylic cover for component safety
- Modular organization of circuit functions
- Test points to access signals at every stage of circuit operation
- Multimedia based interactive e-manual

SPECIFICATIONS

On-board signals Frequency

- 500Hz

Amplitude

- 0 ~ 4 Vpp

Data clock

- 64 Kbps, 128Kbps, 256Kbps, 512Kbps

ADC word length

- 8 – bits

Modulation techniques

- DPCM and ADPCM

Clock frequency

- 8 KHz

Coding

- μ -law

input receiver

- 64 KHz ~ 512KHz

Switch faults

- 8 switch faults are provided onboard to study different effects on circuit

Interconnection

- 2 mm banana socket

Test points

- Several test points are provided to observe various intermediate signals

EXPERIMENTS

- Study of DPCM modulation technique
- Study of ADPCM modulation technique



		<ul style="list-style-type: none"> • Study of DPCM demodulation technique • Study of ADPCM demodulation technique • Quantization error in DPCM • Effect of switch faults • Channel and noise effect in DPCM and ADPCM <p>To study voice communication through DPCM and ADPCM</p>
16	QPSK, DQPSK Modulator & Demodulator	<p>QPSK/DQPSK Modulation And Demodulation Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • VLSI based design • Separate component and operational area • Acrylic cover for component safety • Modular organization of circuit functions • Test points to access signals at every stage of circuit operation <p>SPECIFICATIONS</p> <p>Data simulator</p> <ul style="list-style-type: none"> • On – board 8 – bit variable NRZ – L pattern <p>Crystal oscillator</p> <ul style="list-style-type: none"> • 32.786 MHz <p>Clock frequency</p> <ul style="list-style-type: none"> • 256KHz <p>Data encoding</p> <ul style="list-style-type: none"> • NRZ (L), di – bit data (even data and odd data) differentially encoded even data and odd data <p>Carrier modulation</p> <ul style="list-style-type: none"> • QPSK, DQPSK <p>Data decoding</p> <ul style="list-style-type: none"> • NRZ (L), di – bit data (even data and odd data) differentially decoded even data and odd data <p>Constellation diagram</p> <ul style="list-style-type: none"> • Provision for observing constellation diagram and the concept can be well understood <p>Intermediate signal</p> <ul style="list-style-type: none"> • Provision for observing 2 intermediate signals during demodulation; one for even and other for odd data <p>Inter connection</p> <ul style="list-style-type: none"> • 2 mm banana socket <p>Power supply : GND, +12V, -12V, +5V</p> <p>Test points : 28</p> <p>EXPERIMENTS</p>



		<ul style="list-style-type: none"> To study dibit pair data coding technique of NRZ – L data To study the differential encoding of dibit data <ol style="list-style-type: none"> To study and observe constellation diagram To study bandwidth efficiency of QPSK To study quadrature phase shift keying (QPSK) modulation and demodulation technique <p>To study differential quadrature phase shift keying (DQPSK) modulation and demodulation technique</p>
17	Sampling & Reconstruction Technique	<p>Analog Signal Sampling and Reconstruction kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> Separate component and operation area Acrylic cover for component safety Modular organization of circuit functions Test points to access signals at every stage of circuit operation Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <p>Onboard signals</p> <p>Sine wave</p> <ul style="list-style-type: none"> Frequency : 1KHz, 2KHz Amplitude : 0 ~ 5Vpp <p>Sampling clock</p> <ul style="list-style-type: none"> Internal frequency : 2 KHz, 4KHz, 8KHz, 16KHz, 32KH, and 64KHz Duty cycle : 10 ~ 90% selectable in steps of 10% <p>Sampling methods</p> <ul style="list-style-type: none"> Natural sampling circuit Sample and hold circuit Flat top sampling circuit <p>Reconstruction</p> <ul style="list-style-type: none"> 2nd order and 4th order low pass butterworth filters with 3.4 KHz cut-off frequency <p>Switch fault</p> <ul style="list-style-type: none"> 7 Switch faults are provided on-board to study different effects on circuit <p>Interconnection</p> <ul style="list-style-type: none"> 2 mm banana socket Two 4pin connector for audio input / output kit <p>Test points</p>



		<ul style="list-style-type: none"> 24 test points are provided on board to observe various intermediate signals <p>Power supply</p> <ul style="list-style-type: none"> GND, +5V, +12V, -12V <p>EXPERIMENTS</p> <ul style="list-style-type: none"> Principles of analog signal sampling and reconstruction Effect of different sampling frequencies Effect of varying the sampling frequency duty cycle Study of 2nd order and 4th order low pass butterworth filters Effect of switch faults <p>Voice communication (optional)</p>
18	Stereo FM Radio Trainer	<p>Amplitude Modulation Transmitter Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> On-board audio oscillator of 100Hz ~ 10KHz frequency Voltage controlled oscillator of 400KHz ~ 1500KHz frequency Balanced modulators for DSB/SSB AM generator Colpit's oscillator of 1 MHz Audio per-amplifier Output amplifier 400KHz ~ 1650KHz Ceramic filter of 455KHz Band pass filter at 455KHz with 10KHz bandwidth On-board antenna Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <p>Audio oscillator (sine wave generator)</p> <ul style="list-style-type: none"> Frequency : 100Hz ~ 10KHz Amplitude : 0 ~ 2Vpp Audio input : Audio preamplifier with microphone input <p>Voltage controlled oscillator (VCO)</p> <ul style="list-style-type: none"> Output signal : sine wave Frequency range : 1) 400KHz ~ 500KHz 2) 400KHz ~ 1500KHz Amplitude : 0~2Vpp Output impedance : 50Ω <p>AM/DSB/SSB/modulator</p> <ul style="list-style-type: none"> Modulation : Amplitude modulation : double side band



: Single side band (LSB)

- Carrier input : 1 ~ 1000KHz
- Modulating input : 1 ~ 100KHz
- Carrier null : Adjustable
- Output amplitude : Adjustable

Ceramic filter

- Center frequency : 455KHz
- Bandwidth : 10 KHz \pm 3 KHz

Output amplifier

- Gain adjustable connected to cable or antenna

Antenna

- MW Coil

Switch faults

- 4 switch faults are provided on board to study different effects on circuit

Interconnection

- 2mm banana socket

Power supply

- GND, +5V, +12V, -12V

EXPERIMENTS

- Study of double side band AM generator
- Study of single side band AM generator
- Study of adjustment of transmitter tuned circuits
- Voice transmission with DSB/SSB AM transmission
- Effect of switch faults

Amplitude Demodulation Receiver kit

FEATURES

- Super-heterodyne AM receiver with AGC (400KHz ~ 1500KHz)
- RF amplifier 400KHz ~ 1650KHz
- Local oscillator If 500KHz ~ 2.1MHz frequency
- Beat frequency oscillator from 400~500MHz
- Mixer
- 1st IF and 2nd IF amplifier
- Envelope detector
- Audio amplifier with gain 20dB
- On-board antenna
- Multimedia based interactive e-manual

SPECIFICATIONS

Super heterodyne receiver

- Frequency : 400KHz ~ 1.5MHz



	<ul style="list-style-type: none"> • Intermediate frequency :455KHz • Inputs :RF signal • Output IF frequency :455Khz adjustable • IF filter :Dual tune LC • RF amplifier with variable gain
	Mixer (frequency converter) <ul style="list-style-type: none"> • Dual Gate MOSFET • Input :Local Oscilloscope and RF • Output frequency :455Khz adjustable • Band pass filter :455KHz center frequency
	Voltage controlled oscillator <ul style="list-style-type: none"> • Output signal :Sine wave for local oscillator input • Frequency :From 400 KHz ~ 1500KHz • Amplitude :Adjustable From 0~2Vpp • Output impedance : 50Ω
	1st IF and 2nd IF amplifier <ul style="list-style-type: none"> • Central frequency :455 KHz • Local impedances :Variable R-L-C • Gain :40 dB with automatic gain control
	Diode envelope detector <ul style="list-style-type: none"> • Detection of the positive and negative envelope with variable RC filter DSB
	Product detector <ul style="list-style-type: none"> • Operating frequency : Adjustable from 400KHz ~ 500KHz SSB • Input amplitude : 1Vpp
	Audio output <ul style="list-style-type: none"> • Amplifier with speaker • Audio amplifier gain : 20dB
	Receiving media <ul style="list-style-type: none"> • MW coil antenna and via cable
	Switch faults <ul style="list-style-type: none"> • 4 Switch faults are provided on board to study different effects on circuit
	Interconnection <ul style="list-style-type: none"> • 2 mm banana socket



		Power supply <ul style="list-style-type: none"> GNC, +5V, +12V, -12V EXPERIMENTS <ul style="list-style-type: none"> Study of double sideband AM reception using envelope diode detector Study of single side band AM reception using product detector Study of image frequencies Study of adjustment of receiver tuned circuits Voice reception using DSB/SSB AM receiver (super heterodyne receiver) Effects of switch faults
19	TDM - PAM Transmitter Receiver	PAM Time Division Multiplexing /Demultiplexing Kit FEATURES <ul style="list-style-type: none"> Separate component and operational area Acrylic cover for component safety Modular organization of circuit functions Test points to access signals at every stage of circuit operation Multimedia based interactive e-manual SPECIFICATIONS <p>On board signals</p> <p>Sine waves</p> <ul style="list-style-type: none"> Frequency : 250Hz, 500Hz, 1KHz, 2KHz Amplitude : 0 ~ 5Vpp DC signal : 0 ~ -5V <p>Input channels : 4</p> <p>Multiplexing : time division multiplexing</p> <ul style="list-style-type: none"> Sampling rate : 32 KHz <p>Modulation : pulse amplitude modulation</p> <p>Receiver clock</p> <ul style="list-style-type: none"> Phase lock loop generates receiver clock and channel information <p>Low pass filter</p> <ul style="list-style-type: none"> 4th order butter worth filters (3.4 KHz cut off) <p>Switch faults</p> <ul style="list-style-type: none"> 8 switch faults are provided on board to study different effects on circuit <p>Interconnection</p> <ul style="list-style-type: none"> 2 mm banana socket Two 4 pin connector for audio input/output kit



		<p>Test Points</p> <ul style="list-style-type: none"> 39 test points are provided to observe various intermediate signals <p>Power supply</p> <ul style="list-style-type: none"> GND, +5V, +12V, -12V <p>EXPERIMENTS</p> <ul style="list-style-type: none"> Principles of time division multiplexing Study of TDM pulse amplitude modulation/demodulation Study of TDM Pulse amplitude modulation/demodulation with channel identification information To study the use of a threshold level comparator and phase locked loop circuitry Effect of switch faults <p>Voice communication (optional)</p>
20	TDM Pulse Code Demodulator and Receiver	<p>Pulse code Demodulation Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> Separate component and operational area Acrylic cover for component safety Modular organization of circuit functions Test points to access signals at every stage of circuit operation LED indication of digital patterns Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <ul style="list-style-type: none"> Input channels 2 channel time division multiplexed pulse code modulation receiver Receive clock Generated by phase lock loop Parity check facility Even, odd, hamming Error correction Hamming code <p>Low pass filter</p> <ul style="list-style-type: none"> Two 4th order butterworth filter, 3.4 KHz (cut – off) <p>Switch faults</p> <ul style="list-style-type: none"> 4 switch faults are provided on board to study different effects on circuit <p>Interconnection</p> <ul style="list-style-type: none"> 2 mm banana socket



		<ul style="list-style-type: none"> • 4 pin connector for audio output kit <p>Test points</p> <ul style="list-style-type: none"> • 25 test points are provided to observe various intermediate signals <p>Power supply</p> <ul style="list-style-type: none"> • GND, +5V, +12V, -12V <p>EXPERIMENTS</p> <ul style="list-style-type: none"> • Principles of pulse code demodulation techniques • Study of 2 channel time division demultiplexing and pulse code demodulation • Study principle of digital to analog converter • Study of pseudo random bit sequence generation • Study of error control coding technique using odd parity even parity and hamming parity • Synchronization techniques • Bit synchronization • Frame synchronization • Effect of switch faults <p>Voice communication (optional)</p>
21	TDM Pulse Code Modulation & Transmitter	<p>Pulse code Modulation Kit</p> <p>FEATURES</p> <ul style="list-style-type: none"> • Separate component and operational area • Acrylic cover for component safety • Modular organization of circuit functions • Test points to access signals at every stage of circuit operation • LED indication of digital patterns • Multimedia based interactive e-manual <p>SPECIFICATIONS</p> <p>Input channels</p> <ul style="list-style-type: none"> • 2 channel time division multiplexed pulse code modulation receiver <p>Receive clock</p> <ul style="list-style-type: none"> • Generated by phase lock loop <p>Parity check facility</p> <ul style="list-style-type: none"> • Even, odd, hamming <p>Error correction</p> <ul style="list-style-type: none"> • Hamming code <p>Low pass filter</p> <ul style="list-style-type: none"> • Two 4th order butterworth filter, 3.4 KHz (cut – off)



		<p>Switch faults</p> <ul style="list-style-type: none"> 4 switch faults are provided on board to study different effects on circuit <p>Interconnection</p> <ul style="list-style-type: none"> 2 mm banana socket 4 pin connector for audio output kit <p>Test points</p> <ul style="list-style-type: none"> 25 test points are provided to observe various intermediate signals <p>Power supply</p> <ul style="list-style-type: none"> GND, +5V, +12V, -12V <p>EXPERIMENTS</p> <ul style="list-style-type: none"> Principles of pulse code demodulation techniques Study of 2 channel time division demultiplexing and pulse code demodulation Study principle of digital to analog converter Study of pseudo random bit sequence generation Study of error control coding technique using odd parity even parity and hamming parity Synchronization techniques <ul style="list-style-type: none"> Bit synchronization Frame synchronization Effect of switch faults <p>Voice communication (optional)</p>
22	Transmission Line Trainer	<p>Co-Axial Transmission Line Trainer</p> <p>SPECIFICATIONS</p> <p>Transmission line</p> <ul style="list-style-type: none"> Coaxial Cable 100m (25m x 4) Impedance matching 0ohm to 100ohm variable load (quantity 2), 1ohm fixed load <p>Interconnections</p> <ul style="list-style-type: none"> 2mm sockets on all input / output connections <p>Experiments</p> <ul style="list-style-type: none"> Measuring the characteristics of an actual transmission line such as R, L, C, G, Zo, for different lengths of transmissions Line Measuring the attenuation of a transmission line for different lengths of the transmission line for Open ended line, Short ended line, Matched line Measuring the Input Impedance of the line



		<p>under different load conditions</p> <ul style="list-style-type: none"> • Frequency characteristics of the line • Study of stationary waves for different load condition • Fault localization within the line • Line under pulsed condition. Study the propagation of the pulse edges along the line under different matching condition viz., open line, short-circuited line and matched line • Measuring velocity of propagation and dielectric constant for different load conditions • Effect of reactive load on transmission line <p>Accessories</p> <ul style="list-style-type: none"> • RFL-CTLT • BNC cables • T-Connector (BNC) • Experimental manual • Patch cords
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(In letterhead of the supplier with seal)

To:

1

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: _____

