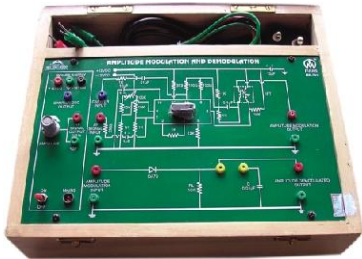


# COMMUNICATION LAB TRAINING MODULES

## Amplitude Modulation & Demodulation

ME 741



- Observe change in the carrier amplitude according to the amplitude of the modulating signal.
- Calculate modulation index of the modulated signal.
- Recovery of modulating signal from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 12V/500mA$ .
- On board sine wave audio frequency signal generator  
Frequency : 1KHz                      Amplitude : 0-2Vpp
- On board carrier signal generator  
Frequency : 455 KHz                      Amplitude : 2.5 Vpp
- Modulation using balanced modulator IC LM 1496.
- Demodulation using diode detector OA 79.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points are brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

## Frequency Modulation & Demodulation

ME 742



- Observe change in the carrier frequency according to the amplitude of the modulating signal.
- Calculate modulation index of the modulated signal.
- Recovery of modulating signal from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 12V/250mA$ .
- On board sine wave audio frequency signal generator  
Frequency: 2 KHz & 4KHz                      Amplitude: 0-2.8 Vpp
- Modulation using VCO 8038 (Carrier generator internally 62KHz, 5.5Vpp)
- Demodulation circuit using phase locked loop IC LM 565.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

# COMMUNICATION LAB TRAINING MODULES

## Pulse Amplitude Modulation & Demodulation

ME 743



- Observe flat top samples, natural samples, sample & hold at different sampling frequencies.
- Recovery of modulating signal from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply +12V, + 5V/ 300mA .
- On board sine wave audio frequency signal generator  
Frequency : 1 KHz & 2KHz      Amplitude : 0-10Vpp & 0-4 Vpp
- On board sampling pulse generator  
Frequency : 8KHz, 16KHz, 32KHz, 64KHz      Amplitude : 5Vpp
- Modulation using IC 7555 multivibrator.
- Demodulation of PAM using 4 order / low pass filter & AC amplifier using TL<sup>074</sup> with adjustable gain control.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement : 230 VAC +10%, 50Hz.

### Standard Accessories

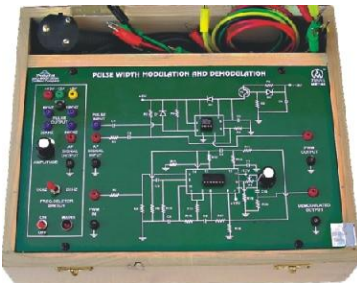
- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

## Pulse Width Modulation & Demodulation

ME 744



- Observe change in width of clock pulses according to the amplitude of the modulating signal at the different clock frequencies.
- Recovery of modulating signal from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply +12V, + 5V/ 300mA.
- On board sine wave audio frequency signal generator  
Frequency: 1 KHz & 2KHz      Amplitude: 0-10Vpp & 0-4 Vpp
- On board sampling pulse generator (Frequency: 8KHz, 16KHz, 32KHz, 64KHz Amplitude: 5Vpp)
- Modulation using IC 7555 multivibrator.
- Demodulation of PWM using 4<sup>th</sup> order / low pass filter & AC amplifier using TL<sup>074</sup> with adjustable gain control.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement: 230 VAC +10%, 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

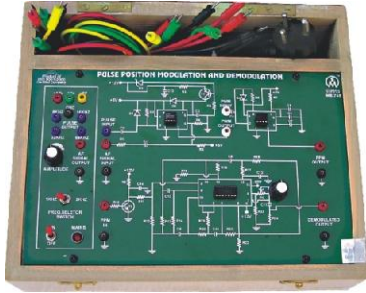
### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

# COMMUNICATION LAB TRAINING MODULES

## Pulse Position Modulation & Demodulation

ME 745



- Observe change in position of clock pulses according to the amplitude of the Modulating signal at the Different clock frequencies.
- Recovery of modulating signal from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply  $+12V$ ,  $+5V/300mA$ .
- On board sine wave audio frequency signal generator  
Frequency : 1 KHz & 2KHz      Amplitude : 0-10Vpp & 0-4 Vpp
- On board sampling pulse generator (Frequency : 8KHz, 16KHz, 32KHz, 64KHz  
Amplitude : 5Vpp)
- Modulation using IC 7555 multivibrator and pulse width modulation as input.
- Demodulation of PPM using 4<sup>th</sup> order / low pass filters & AC amplifier using TL<sup>074</sup> with adjustable Gain control.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

## PAM/PPM/PWM Modulation & Demodulation

ME 746



- Observation of PAM, PPM, PWM modulated & demodulated waveforms.
- Study of PAM with sample, sample & hold and flat-top modulating outputs.
- Study of PPM using DC and AC (sine wave) modulating signals.
- Study of PWM & demodulation using different sampling frequencies.
- Study of voice communication using PAM, PPM & PWM Techniques.
- Recovery of modulating signals from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply  $+12V$ ,  $+5V/300mA$ .
- On board sine wave audio frequency signal generator (Frequency : 1 KHz & 2KHz Amplitude : 0-10Vpp & 0-4 Vpp).
- On board square wave signal generator (Frequency : 1 KHz & 2KHz Amplitude : 5Vpp).
- On board sampling pulse generator (Frequency : 8KHz, 16KHz, 32KHz, 64KHz Amplitude : 5Vpp).
- Demodulation of PAM/PPM/PWM using 4<sup>th</sup> order / low pass filter & AC amplifier using TL<sup>074</sup> with adjustable gain control.
- Voice Communication: Voice Link using dynamic Mic & Speaker.
- DC Output : 0-4V (Variable).
- 8 Nos. Fault Switches & 29 Test Points.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

- Power Chords, Patch Chords, Sensitive MIC, Head Phone & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

# COMMUNICATION LAB TRAINING MODULES

## Phase Modulation & Demodulation

ME 747

- To observe change in the phase of carrier according to the amplitude of the modulating signal.
- Recovery of modulating signal from demodulator circuit using phase locked loop circuit.

### Technical Specifications

- In built IC based DC regulated power supply  $+15V, \pm 9V/ 300mA$ .
- On board sine wave audio frequency signal generator (Frequency : 1 KHz - 10KHz Amplitude : 0-10Vpp)
- Modulation using VCO2206 (Carrier generator internally 90KHz, 5.6Vpp).
- Demodulation using Phase locked loop IC 565 follow an amplifier 741.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

## Frequency Shift Keying Modulation & Demodulation

ME 748



- To observe shift in frequency of carrier signal according to binary input i.e. Digital clock signal.
- Recovery of modulating signal from demodulator circuit using phase locked loop circuit.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 5V/300mA$ .
- On board square wave audio frequency signal generator. Frequency: 100Hz - 1KHz Amplitude: 0-30Vpp
- Modulation using IC 555(Carriers generator internally 1.4KHz, 5Vpp).
- Demodulation using phase locked loop IC 565 (lock range 100Hz, 300Hz) and comparator IC 741.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

## Amplitude Shift Keying Modulation & Demodulation

ME 749



- To observe shift in carriers amplitude according to the binary input i.e. Digital clock signal.
- Recovery of data signal from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 12V, +5V/250mA$ .
- On board three data signal generator (Frequency: 5KHz Amplitude: 4Vpp).
- On board carrier signal generator (Frequency: 100KHz Amplitude: 5Vpp).
- Modulation using linear multiplier (balanced modulator using IC LM 1496).
- Demodulation using diode as envelop detector, low pass filter using IC TL 082 followed by Comparator IC using LM 311.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

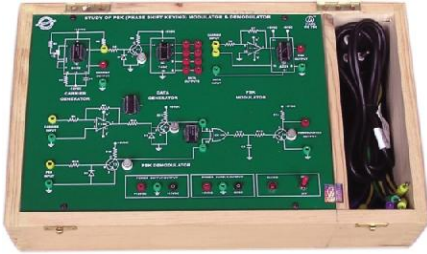
### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

# COMMUNICATION LAB TRAINING MODULES

## Phase Shift Keying Modulation & Demodulation

ME 750



- To observe shift in phase of carrier according to the binary input i.e digital clock pulses.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 12V, +5V/300mA$ .
- On board sine wave carrier signal generator.  
Frequency: 22 KHz Amplitude: 5Vpp
- On board data generator using IC 7490.
- Modulation using IC 4051.
- Demodulation using TL084 & IC 7486.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

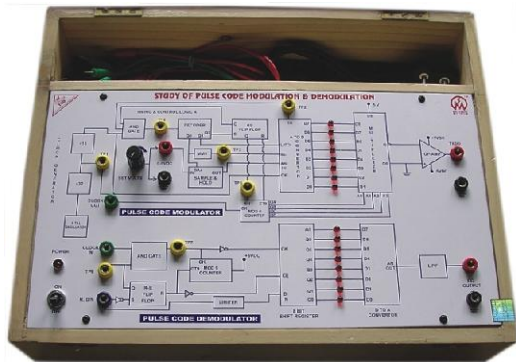
- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

## Pulse Code Modulation & Demodulation

ME 751



- To observe the conversion of DC signal in to digital signal using sample & hold and A/D converter.
- The PCM system is divided in five blocks i.e clock generator, sample & hold amplifier, analog to digital converter, multiplexer, timing and control logic.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 12V, +5V/500mA$ .
- On board DC supply as modulating signal (0-5VDC).
- On board clock signal generator (Frequency: 7.8 KHz & 125KHz Amplitude: 5 Vpp).
- Modulation using sample & hold amplifier IC LF 398, analog to digital converter using IC 0800, parallel to serial converter using IC 74150 multiplexer and timing and control logic using 74160.
- Demodulation of PCM using timing & control logic using 74160 digital to analog converter using IC 0800 and low pass filter follow by an amplifier using 741.
- Block diagram printed on front panel & all test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020)
- Digital Multimeter (VC-97).

## Delta Modulation & Demodulation

ME 752



- To Observe the delta modulation & demodulation of a modulating signal.
- Recovery of modulating signal from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 12V +5V/300mA$ .
- On board sine wave audio frequency signal generator  
Frequency: 300Hz Amplitude : 0-4Vpp
- On board carrier signal generator (Frequency:16KHz Amplitude: 5Vpp).
- Modulation using comparator IC LM 311, updown counter 74193 and digital to analog converter IC DAC 0800.
- Demodulation using low pass filter.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

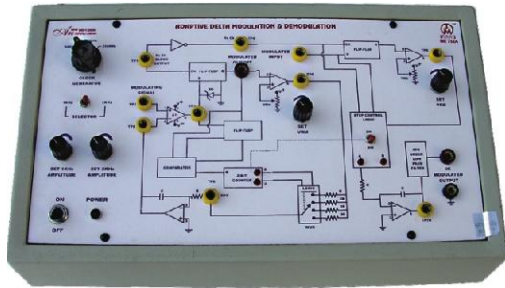
### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

# COMMUNICATION LAB TRAINING MODULES

## Adaptive Delta Modulation & Demodulation

ME 753



- To observe linear delta modulation, adaptive delta & sigma delta modulation.
- To cure the problem of slop overloading by adaptive control circuit and a study of effect on demodulation signal by changing in sampling Frequency.
- Recovery of modulating signal from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply +12V/ & +5V/500mA.
- On board sine wave audio frequency signal generator (Frequency :1KHz & 2KHz Amplitude: 0-8Vpp).
- On board sampling pulse generator (Frequency: 64KHz,128KHz, 256KHz Amplitude: 5Vpp).
- Modulation using a flip flop, a unipolar to bipolar converter, an integrator and a comparator. A step control logic is an additional circuit which can be brought in or out by mean of another miniature toggle switch available in demodulator circuit.
- Demodulation using flip flop, a unipolar to bipolar converter, an integrator and 4th order low pass filter.
- Block diagram printed on front panel & test point brought out on front panel.
- Power requirement: 230 VAC  $\pm$ 10%, 50Hz.

### Standard Accessories

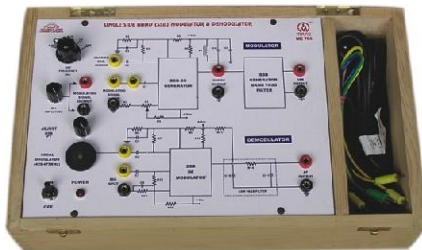
- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

## Single Side Band Modulation & Demodulation

ME 754



- To observe the single side band modulation by producing DSB-SC signal & then by passing it through the band pass filter using crystal .
- Recovery of modulating signal from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply +12V/250mA .
- On board sine wave audio frequency signal generator. Frequency: 1.8KHz, 2.8KHz, 5.3KHz, 7KHz, 10KHz. Amplitude: 240mVpp.
- Modulation using balanced modulator IC 1496 & band pass filter using crystal.
- Demodulation of SSB using balanced modulator IC 1496 and local oscillator Frequency 420-475KHz.
- Block diagram printed on front panel & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm$ 10%, 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

# COMMUNICATION LAB TRAINING MODULES

## Sample & Hold Circuit using Op-Amp

ME 756

- To observe the sampling of an analog time varying signal at different sampling frequencies & also hold the signal using hold capacitor & also observe the drop rate on slow sampling times.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 12V$  &  $+5V/250mA$  .
- On board sine wave audio frequency signal generator (Frequency: 1KHz Amplitude: 0- 2 Vpp).
- On board sampling pulse generator.  
Frequency: 2KHz, 4KHz, 8KHz, 16KHz Amplitude: 5Vpp
- On board duty cycle change arrangement.
- Modulation using sample & hold amplifier LF 398.
- Block diagram printed on front panel & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

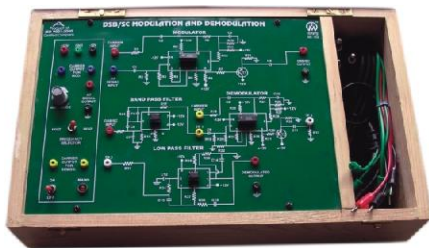
- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

## Balanced Modulator/DSB-SC (DSB-SC Amplitude Modulation & Demodulation)

ME 758



- To observe the double side band suppressed carrier modulation by suppressing the carrier power.
- Recovery of modulating signal by selecting the carrier frequency using band pass filter, separate detector & low pass filter.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 12V$  /500mA.
- On board sine wave audio frequency signal generator (Frequency: 1KHz, 2KHz Amplitude: 0-2Vpp)
- On board carrier signal generator sine wave (Frequency: 60KHz, 40KHz Amplitude: 5Vpp & 5Vpp).
- Modulation using balanced modulator IC 1496.
- Demodulation using band pass filter using IC TI081, followed by low pass filter using TI082.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement: 230 VAC  $\pm 10\%$ , 50Hz.

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO 20MHz (ME 3020).

# COMMUNICATION LAB TRAINING MODULES

## Analog Signal Sampling & Reconstruction

ME 760

- To observe how the analog signal is sampled according to the sampling Frequencies.
- Recovery of modulating signal from demodulator circuit.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 15V$  &  $+5V/500mA$  and  $0-10VDC$  (Variable).
- On board sine wave audio frequency signal generator (Frequency:  $300Hz$  Amplitude:  $6.5V_{pp}$ ).
- On board sampling pulse generator (Frequency:  $100Hz - 1KHz$  Amplitude:  $6.5V_{pp}$ ).
- Modulation using transistorised circuit CL 100.
- Demodulation using low pass filter.
- Circuit diagram printed on front panel & test points brought out on front panel.
- Power requirement:  $230 VAC \pm 10\%$ ,  $50Hz$ .

### Standard Accessories

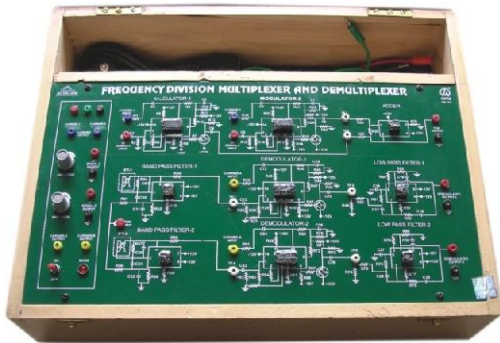
- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO  $20MHz$  (ME 3020).

## Frequency Division Multiplexer & Demultiplexer

ME 761



- To observe the different signals are transmitted in a given band width by using the different carrier frequencies.
- Recovery of modulating signal by selecting the various carrier frequencies using band pass filters and separate Detectors.

### Technical Specifications

- In built IC based DC regulated power supply  $\pm 12V$ .
- On board sine wave audio frequency signal generator  
Frequency:  $1KHz$  &  $2KHz$  Amplitude:  $0-2V_{pp}$
- On board carrier's signal generator sine wave  
Frequency:  $60KHz$  &  $40KHz$  Amplitude:  $5V_{pp}$  &  $5V_{pp}$
- Modulation using balanced modulator using IC 1496 followed by an adder using IC TL081
- Demodulation using balanced modulator using IC 1496, band pass filter using IC TL081 followed by low pass filter.
- Circuit diagram printed on Glass Epoxy PCB & all important IC's & test points brought out on front panel.
- Power requirement:  $230 VAC \pm 10\%$ ,  $50Hz$ .

### Standard Accessories

- Power Chord, Patch Chords & Instruction Manual.

### Optional Accessories

- Dual Trace CRO  $20MHz$  (ME 3020).