## **Amplitude Modulation**



**Dr. B Kanmani** Department Head, Telecommunication Engineering Rindlone - 50 mil

#### BMS College of Engineering (BMSCE), Bangalore, India

## **OBJECTIVES**:

At the end of performing this experiment, learners would be able to:

- Describe the concept of Amplitude Modulation
- Obtain the AM from given input
- Understand the working of LF398 IC (sample-and-hold circuit)
- Understand the working of µA 741 IC

## **EQUIPMENT**:

- IC LF398
- IC µA 741
- Signal generator
- Resistors 47 k $\Omega$ , 1 k $\Omega$
- Capacitor 0.01 µF
- Decade inductance box
- +/- 15V DC Power Supply
- Digital Storage Oscilloscope & probes
- Connecting wires & Bread Board

#### **DESIGN OF BPF**:

f = 1/(2π√LC)f = 30kHz L = ? let C= 0.01μF

L= 2.18mH

## THEORY:

• LF398 is a monolithic sample-and-hold circuit utilizing BI-FET technology for accurate fast acquisition of input signal.

• A sample and hold circuit is an analog device that samples (captures) the voltage of a continuously varying analog signal and holds (locks) its value at a constant level for a specified minimum period of time (hold time). They are typically used in analog-todigital converters to eliminate variations in input signal that can corrupt the conversion process.

• Amplitude Modulation is defined as the modulation in which the amplitude of the carrier wave is varied in accordance with the instantaneous amplitude of the modulating signal keeping its frequency and phase constant

#### Reference reading:

B Kanmani, "Some applications of the combination: LM-741 and LF - 398", WASET CESSE 2009: International conference on Computer, Electrical and Systems science and Engineering, Rome, 28th-30thApril, Italy, 2009.Volume 52, April 2009, ISSN: 2070-3724, pages 335-340.

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## AM -- Procedures

## Step 1

#### Circuit setup:

Build the following circuit with given component values



Square-wave carrier

# Step 2

• Use a signal generator to generate modulating signal m(t) (sine wave of 5kHz for example) with dc offset, and carrier frequency (square wave signal).

• Design the BPF for the carrier frequency of 30kHz

• Turn on the supply of the circuit and enable signal generator that is feeding signal to the circuit.

 Tune the circuit, by varying the carrier frequency so that output of the BPF is maximum • The modulating signal will be set to 5 kHz Sine wave

## Step 3

• Connect the DSO probe – CH1 at modulating input (pin # 3 of LF398 IC), CH2 at carrier input (pin # 8 of LF398 IC), CH3 at (pin # 6 of  $\mu$ A 741 IC) and CH4 at output

• Perform Autoset on DSO and capture the output signal.

# Step 4

• Configure PEAK-to-PEAK measurement on the input and output signal.

• Observe - input and output on DSO and record the signal

## Step 5



# Step 6

## **Observation:**

Op-Amp output will be 180degree phase shifted

## Open-ended Question / Can you answer this?

What will be the effect on output waveform if:

- 1) Capacitor vaule is changed from  $0.01\mu$ F to  $0.1\mu$ F?
- 2) modulating signal dc-offset is not given ?