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| **Course Name:** | **Analogue Digital Systems** | **Semester:** | **IV** |
| **Date of Performance:** | **16 / 01 / 2024** | **Batch no.:** | **A - 2** |
| **Faculty Name:** | **Prof. Amrita Naiksatam** | **Roll no.:** | **16014022050** |
| **Faculty Sign & Date:** |  | **Grade / Marks:** | **\_\_\_ / 25** |

**Experiment No: 1**

**Title:** **To Generate DSB –FC Amplitude Modulated Signal**

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| **Aim and Objective of the Experiment:** |
| * To generate and study DSB –FC Amplitude Modulated Signal. * Observe changes in AM signal with respect to following condition,  1. M <1 2. M=1 3. M>1 |

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| **COs to be achieved:** |
| CO1: Analyze and compare analog modulation schemes. |

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| **Theory:** |
| AM is the modulation process in which the high frequency carrier amplitude is varied in accordance with the modulating signal. The mathematical expression of AM can be written as:  Eam= V [1+ m.sinωmt].Sinωct  On analyzing the expression, it is found that the AM Spectrum consists of carrier, upper side band and lower side band frequencies. The modulation Index in AM is defined as the ratio of maximum modulating voltage to maximum carrier voltage.  M = Em / Ec  The demodulation of AM waveform is carried out by passing the signals through the rectifier detector but the diode used is normally point contact or high frequency diode. The filter time constant is very important as it may lead to diagonal clipping of waveform.  The modulation process produces a carrier & two side bands called as double side band full carrier (DSBFC). The carrier carries no information and consumes power.  Thus, this carrier is suppressed & the signal is called double side band suppressed carrier (DSBSC). V**m** (t) is the modulating signal & V**c**(t) is the carrier signal.  V**m**(t) = Bsin(2лft) & V**c**(t) = Asin(2лft)  The modulated signal consists of three components:   * A sin (2лft) carrier * (mA/2) cos [2л (F-f) t] lower side band * (mA/2) cos [2л (F-f) t] upper side band |

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| **Circuit Diagram:** |
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| **Post Lab Subjective / Objective type Questions:** |
| 1. **The bandwidth of AM wave is given by**    1. **fc + fm**    2. **fc – fm**    3. **2fm**    4. **2fc** 2. **Write the expression for instantaneous voltage of AM wave.**      1. **State the significance of Modulation index in AM signals.**   The modulation index, often denoted as "m" in the context of amplitude modulation (AM) signals, is a crucial parameter that signifies the degree of modulation applied to the carrier wave. The modulation index is defined as the ratio of the peak amplitude of the message signal (amplitude of the audio signal being transmitted) to the peak amplitude of the carrier wave. Mathematically, it is expressed as:  Modulation Index (m) = Amplitude of Message Signal / Amplitude of Carrier Signal  ​  The significance of the modulation index in AM signals lies in its impact on various aspects of the modulated waveform and the efficiency of the communication system:   * Amplitude Variation:   The modulation index determines the extent of variation in the amplitude of the carrier wave. A higher modulation index results in a greater amplitude variation, leading to a more significant modulation depth.   * Spectral Bandwidth:   The bandwidth of an AM signal is directly influenced by the modulation index. The formula for the bandwidth of an AM signal is 2 × (modulation frequency + carrier frequency). Therefore, the modulation index affects the overall bandwidth occupied by the modulated signal.   * Power Efficiency:   The modulation index is linked to the power efficiency of the transmission. In AM systems, excessive modulation (high modulation index) may lead to overmodulation, causing distortion and inefficiency. On the other hand, insufficient modulation (low modulation index) may result in underutilization of the available bandwidth.   * Overmodulation and Distortion:   Overmodulation occurs when the modulation index exceeds 1. In such cases, the modulated signal can become distorted, as the peaks of the modulation envelope may exceed the amplitude limits of the carrier signal. Careful control of the modulation index is crucial to prevent overmodulation and distortion.   1. **Virtual Lab: (attach Screen Shots)**   <https://kcgcollege.ac.in/Virtual-Lab/Electronics-and-Communication-Engineering/simulation.html>  **Over-Modulation (Vm = 30V, Vc = 15V):**    **Perfect Modulation (Vm = 15V, Vc = 15V):**    **Under Modulation (Vm = 15V, Vc = 30V):**    **Demodulation:** |

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| **Conclusion: (Attach Graphs)** |
| 1. **Under Modulation:**      1. **Perfect Modulation:**      1. **Over Modulation:**     To conclude, our experiment involved generating and examining Double Sideband Full Carrier (DSB-FC) Amplitude Modulated Signals. By systematically observing changes in the AM signal under different modulation index (M) conditions (M < 1, M = 1, M > 1), we gained valuable insights into signal characteristics. Utilizing virtual lab simulations and physical hardware setups, supported by graphical representations, we explored the impact of modulation indices on amplitude modulation. |

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| **Signature of faculty in-charge with date:** |