# Amplitude Modulation & Demodulation

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- Check 'Nalanda' for useful course material and lab related stuff.
- Bring a dedicated lab note book to do rough work.
- Please maintain decency in lab. Mind works faster and better in peaceful atmosphere.
- You may leave lab after evaluation. Make sure that your evaluation is done before you leave lab.
- You may take a short break for 5-7 minutes after one and half hour.
- Note down all useful commands in your notebook.
- Save all your work (e.g., codes, plots) in Google drive or somewhere else for your reference. Delete your work files from your computer.

- You are **NOT** allowed to sleep in the lab. If you do so, you will not get credit for the attendance.

# Important Instructions (contd.,)

- Try to complete all tasks within 2 hours. After 2 hrs, evaluation starts. Each lab carries three marks (one mark for attendance, and two marks for successful completion of tasks)
- For each subtask, create mfiles (e.g., Gibbs.m) and save them with suitable name.
- Prepare a word document naming your name and ID. In it, save all results including plots.
- In all plots, put x-label, y-label, legend, font 'Arial' (font size = **10**), and, Width '**2**'. By doing this, visibility of figures will improve.

- Makeup policy: There is no makeup for lab. However, if you are absent for the $n^{th}$ lab, you can complete it in the $(n + 1)^{th}$ lab. In this scenario, you will be evaluated only for lab tasks. Note that this is allowed with prior permission from the Instructor-in-charge. You may be asked to show a valid proof.

- Consider single-tone modulation, that is, $m(t) = A_m \sin(2\pi f_m t)$
- Understand following commands or library functions
    - clf, clc, clear
    - linspace
    - modulate
    - ammod
- Use the following
    - Generate million samples between 0 and 0.01 using linspace
    - carrier frequency=18 KHz;
    - message signal frequency = 900 Hz
    - carrier peak amplitude = 10 volt
    - message peak amplitude = 5 volt

- Questions:
  1. What is the value of depth of modulation or modulation index ?
  2. Write a program to plot message signal, carrier signal, and, modulated signal without using MATLAB library function. In other words, use AM signal expression directly. Give x-label, y-label, title etc. to all subplots.
  3. Assume $R = 1\Omega$. Compute carrier power $P_c$, transmit power $P_t$, power in sidebands, % power efficiency, and bandwidth.

- Question:
    1. Write a program to plot message signal, carrier signal, and, modulated signal using MATLAB library function **ammod**. Use the same set of parameters given in task 1.(a). Give x-label, y-label, title etc. to all subplots
        - Use sampling frequency fs=400000 Hz; ammod(ms,fc,fs,0,Ac); (ms: message signal)

- Understand following commands or functions
    - linspace
    - modulate
    - nextpow2
    - fft
    - stem
- Use the following
    - Sampling frequency $f_s = 400000$ Hz
    - Carrier frequency $f_c = 100000$ Hz
    - Message signal $m(t) = \cos\left(2\pi \times 10^3 t\right)$
- Question:
    1. Write a program to plot the magnitude spectrum of AM signal. Use MATLAB library function **modulate** for generating AM signal. Use: axis([0 0.5*fs 0 1.5]);
    2. Give useful remarks on the spectrum

- Question:
  1. Write a program to plot variations of carrier power and total sideband power with %modulation
     - You may consider $\mu$ = 0:0.05:1; $A_c = 1$ volt;
  2. Give x-label, y-label, title etc. to all subplots

- Understand following commands or functions
  - amdemod
  - butter
- Use the following
  - Same set of parameters in AM (plus)
  - sampling frequency = 80000;
  - [*num*, *den*] = butter(10,fc*2/fs); (Butterworth LPF)
- Question:
  1. Write a program to plot modulated signal using MATLAB library function **ammod** and demodulated (an estimate of message signal) using MATLAB library function **amdemod**
  2. Give x-label, y-label, title etc. to all subplots