**Experiment 8**

**Examine the Heterodyne Receiver** **using MATLAB R2007a.**

**Objective:**

**Simulink Model:**

**Theory:**

**Heterodyning** is a radio signal processing technique invented in 1901 by Canadian inventor-engineer Reginald Fessenden, in which new frequencies are created by combining or mixing two frequencies. Heterodyning is used to shift one frequency range into another, new one, and is also involved in the processes of modulation and demodulation The two frequencies are combined in a nonlinear signal processing device such as a vacuum tube, transistor, or diode, usually called a *mixer*.In the most common application, two signals at frequencies *f1* and *f2* are mixed, creating two new signals, one at the sum *f1* + *f2* of the two frequencies, and the other at the difference *f1* − *f2*.These new frequencies are called **heterodynes**. Typically only one of the new frequencies is desired, and the other signal is filtered out of the output of the mixer. Heterodynes are related to the phenomenon of "beats" in acoustics.

A major application of the heterodyne process is in the super heterodyne radio receiver circuit, which is used in virtually all modern radio receivers.

**Applications:**

Heterodyning, also called *frequency conversion*, is used very widely in communications engineering to generate new frequencies and move information from one frequency channel to another. Besides its use in the super heterodyne circuit which is found in almost all radio and television receivers, it is used in radio transmitters, modems, satellite communications and set-top boxes, radar, radio telescopes, telemetry systems, cell phones, cable television converter boxes and headends,microwave relays, metal detectors, atomic clocks, and military electronic countermeasures (jamming) systems.

**Mathematical Principle:**

Heterodyning is based on the [trigonometric identity](https://en.wikipedia.org/wiki/Trigonometric_identity):

\sin \theta _{1}\sin \theta _{2}={\frac {1}{2}}\cos(\theta _{1}-\theta _{2})-{\frac {1}{2}}\cos(\theta _{1}+\theta _{2})

The product on the left hand side represents the multiplication ("mixing") of a [sine wave](https://en.wikipedia.org/wiki/Sine_wave) with another [sine wave](https://en.wikipedia.org/wiki/Sine_wave). The right hand side shows that the resulting signal is the difference of two [sinusoidal](https://en.wikipedia.org/wiki/Sinusoidal) terms, one at the sum of the two original frequencies, and one at the difference, which can be considered to be separate signals.

**Procedure:**

1. Open the Matlab and then open the Simulink.
2. Draw the model after that start the simulation.
3. Note the different graph of modulation and demodulation which appears on window.
4. Then check the results which obtained from the graph.

**Conclusion:**

**Q1) Write the applications of Heterodyne Receiver.**

**Q2) What is the role of BPF in Heterodyne Receiver?**

**Q3) What is super heterodyne radio receiver?**

**Output:**

**Assessment Sheet:**

**Name: ----------------------------------------------------**

**Registration No: --------------------------------------**

**Lab No: --------------------------------------------------**

**Date: -----------------------------------------------------**