LEARNING OBJECTIVES – NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY
Thomas Wenzel, Bates College

After completing this unit, a student will be able to:

1. Explain the origins of the two energy levels involved in NMR transitions.
2. Explain what happens to a hydrogen nucleus during the excitation process.
3. Describe the importance of the populations of the two energy states as it affects sensitivity and coupling constants.
4. Describe the two processes by which excited state nuclei relax back to the ground state.
5. Explain the advantages of having a larger applied magnetic field and provide the rationale for each of these advantages.
6. Describe the origin of electron shielding.
7. Explain the origin of nuclear coupling.
8. Predict the multiplet nature of the resonance of a hydrogen atom due to coupling.
9. Identify the parameters that influence the magnitude of a coupling constant.
10. Predict the number of resonances and their multiplet nature for compounds undergoing slow and fast exchange.
11. Explain the classical description of NMR spectroscopy and how it is consistent with the quantum mechanical description.
12. Explain the complete process by which it is possible to obtain a free induction decay.
13. Describe the normal pulse sequence used in Fourier transform NMR.
14. Describe methods or strategies that can be used to improve the sensitivity of NMR.
15. Explain why resonances with long relaxation times have diminished signal and describe how magnetic resonance imaging can be used to generate an image.