The focus of this course is to learn to use X-Ray Diffraction and related structural methods to determine the structures of organics, inorganics, organometallics, biomolecules, minerals, solid state materials, etc. The lecture component will be taught using a non-mathematical approach. It will be integrated with a hands-on lab experience using our Bruker APEX CCD, P4 single crystal, and D8 powder X-ray diffractometers and our computer facilities. Special topics for 2006 include neutron diffraction, electron density visualization, remote diffractometer access, crystallographic & chemical data bases, structure validation, & more! Lecture grading will be by exam or term paper - student’s choice. During the course, you will determine the single crystal structure of a material that has not been previously crystallographically characterized and prepare it for publication in *Acta Crystallographica Section E*, etc. This course is designed both for Chemistry students and for those in allied disciplines such as Biology, Geology, Physics, & Engineering and has been taken very successfully by such students in the past. This class is available for either undergraduate or graduate credit.