NMR SPECTROSCOPY FOR CHEMISTS AND BIOLOGISTS

TYPE OF COURSE : New | Elective | PG
COURSE DURATION : 12 weeks (29 Jul’19 - 18 Oct’19)
EXAM DATE : 16 Nov 2019

PRE-REQUISITES : Under graduate level understanding of Physics and Mathematics
INTENDED AUDIENCE : M. Sc./ PhD and Scientists working in Pharma and Biopharma Industries
INDUSTRIES APPLICABLE TO : Biocon, Wockhardt, Aurobindo Biopharma etc

COURSE OUTLINE :
This course starts with Basic principles of NMR, walks through the analysis of spectra and demonstrates the application of multidimensional NMR spectroscopy in Chemistry and structural Biology.

ABOUT INSTRUCTOR :
Prof. Ashutosh Kumar is working as Associate Professor in the Department of Biosciences and Bioengineering, IIT Bombay. His research area in NMR based structural Biology.

Prof. Hosur is a distinguished Visiting Professor in the Department of Biosciences and Bioengineering, IIT Bombay. Prior to this, he worked as a senior Professor in Tata Institute of Fundamental Reseach, Mumbai.

COURSE PLAN :
Week 1: Nuclear Spin and Magnetic Moments Nuclear Spins in a Magnetic Field Spin Lattice Relaxation Spin temperature Resonance Absorption of Energy and The NMR Experiment Kinetics of Resonance Absorption
Week 2: Selection Rules and Line widths Bloch equations
Week 3: Instruction to operator Algebra 1 Instruction to operator Algebra 2 Instruction to operator Algebra 3 Chemical Shift Anisotropy of chemical shifts Learning spectral simulation
Week 4: Factors Influencing Isotropic Chemical shifts: Spin Spin Coupling Analysis of NMR spectra of molecules 1 Analysis of NMR spectra of molecules 2 Analysis of NMR spectra of molecules 3 Learning spectral simulation
Week 5: Dynamic Effects in the NMR spectra : Two site exchange collapse of spin multiplets Conformational Averaging of J- values Analysis of NMR spectra of molecules with J Values 1 Analysis of NMR spectra of molecules with J Values 2 Analysis of NMR spectra of molecules
Week 6: Principles of Fourier transform NMR Theorems on Fourier transforms Practical aspects of recording FTNMR spectra Free Induction Decay (FID) and the spectrum Pulse repetition rate Folding of signals Acquisition time and the resolution Data processing in FT NMR Learning of Data processing
Week 7: Dynamic range in FTNMR and Solvent suppression The Nuclear Overhauser Effect Experimental Schemes Advanced Treatment Steady state NOE and Transient NOE Assignment based on 7th week lectures spectral simulation
Week 8: Spin Echo Uncoupled spins Spin Echo Coupled spins Spin-lattice relaxation Spin-spin relaxation Polarization transfer SPT and INEPT spectral simulation
Week 9: Density matrix, Elements of Density Matrix Time evolution of density operator,Time evolution of density operator,Product operator formalism Product operator formalism Assignment based on 9th week lectures
Week 10: Segmentation of the time axis Two dimensional NMR 2D Fourier Transformation in NMR Peak shapes in 2D spectrum Quadrature detection in two-dimensional NMR Assignment based on 10th week lectures
Week 11: 2D- resolution/ separation experiments 2D- resolution/ experiments Two-dimensional correlation experiments COSY Two-dimensional correlation experiments COSY2 DQ-COSY etc TOCSY separation
Week 12: 2D NOESY 2D ROESY Heteronuclear COSY The HETCOR pulse sequence HSQC Assignment based on 12th week lectures