ADVANCED NMR TECHNIQUES IN SOLUTION AND SOLID-STATE

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TYPE OF COURSE : New | Elective | PG
COURSE DURATION : 12 Weeks (24 Jan' 22 - 15 Apr' 22)
EXAM DATE : April 24, 2022

PRE-REQUISITES : Basic knowledge of NMR Spectroscopy and Analysis of Spectra

INTENDED AUDIENCE : Postgraduates and Research Students

INDUSTRIES APPLICABLE TO : All pharma industries which have NMR facilities

COURSE OUTLINE :
In this course, after introducing NMR and the internal interaction parameters, I will discuss some advanced concepts and techniques, such as, relaxation phenomenon and their measurements, NOE and ROE, spin system nomenclature, quantum mechanical analysis of spectra, the polarization transfer mechanism, chemical exchange, pure shift NMR, diffusion ordered spectroscopy, spectra of many heteronuclei, two dimensional NMR and routine 2D experiments, product operator formalism, analysis of 2D spectra. The multiple quantum techniques, the solid state NMR, magic angle spinning and cross polarization, CPMAS techniques and solid state NMR experiments will be discussed in detail.

ABOUT INSTRUCTOR :
N. Suryaprakash, is a professor, NMR Research Centre, Indian Institute of Science. His research work is focused on diverse wings of NMR spectroscopy, with a major focus on the manipulation of spin dynamics to design novel NMR techniques to combat inherent challenging problems of NMR spectroscopy, viz., to achieve sensitivity enhancement, higher resolution, discerning of degenerate transitions and facile extraction of spectral information.

COURSE PLAN :

Week 1**:** NMR Introduction, NMR Concepts, Internal Interaction, Chemical Shifts, Internal Interaction, J Couplings, Fourier Transforms and 1D spectra

Week 2**:** Pulse phase and Receive phase, Evolution of chemical shifts, Evolution of Scalar Couplings, Concept of Relaxation, Relaxation Mechanisms

Week 3**:** T1 and T2 measurements, Nuclear Overhauser Effect, NOE and ROE, Coupled Spin Systems Nomenclature

Week 4**:** Weakly and strongly coupled two spin systems, energy levels and transitions , Three coupled spin systems, energy levels and transition frequencies

Week 5**:** Pure Shift NMR, 2D Pure Shift Experiments, Chemical Exchange, Chemical Exchange, Spin Echoes

Week 6**:** Polarization Transfer Techniques, Polarization Transfer Techniques, 13C NMR , 13C NMR, Spectra of Heteronuclei

Week 7**:** Spectra of Heteronuclei, Spectra of Heteronuclei, Phase cycling, Pulse Field Gradients, Diffusion Ordered Spectroscopy

Week 8**:** Diffusion Ordered Spectroscopy, Shaped Pulses spin lock, coherence order, Shaped Pulses spin lock, coherence order

Week 9**:** Modified COSY sequences HSQC, NOESY Pulse Sequences Homo and heteronuclear Resolved spectra Analysis of 2D COSY

Week 10**:** Product Operators: Evolution of coherences, Product Operators: Evolution of coherences, Product Operators: Evolution of coherences

Week 11**:** Difference between Solid state and solution state NMR , Anisotropic NMR parameters: CSA and dipolar couplings

Week 12**:** CPMAS, High Speed CP, Suppression of Spinning side bands, Selected Experiments in Solid state NMR