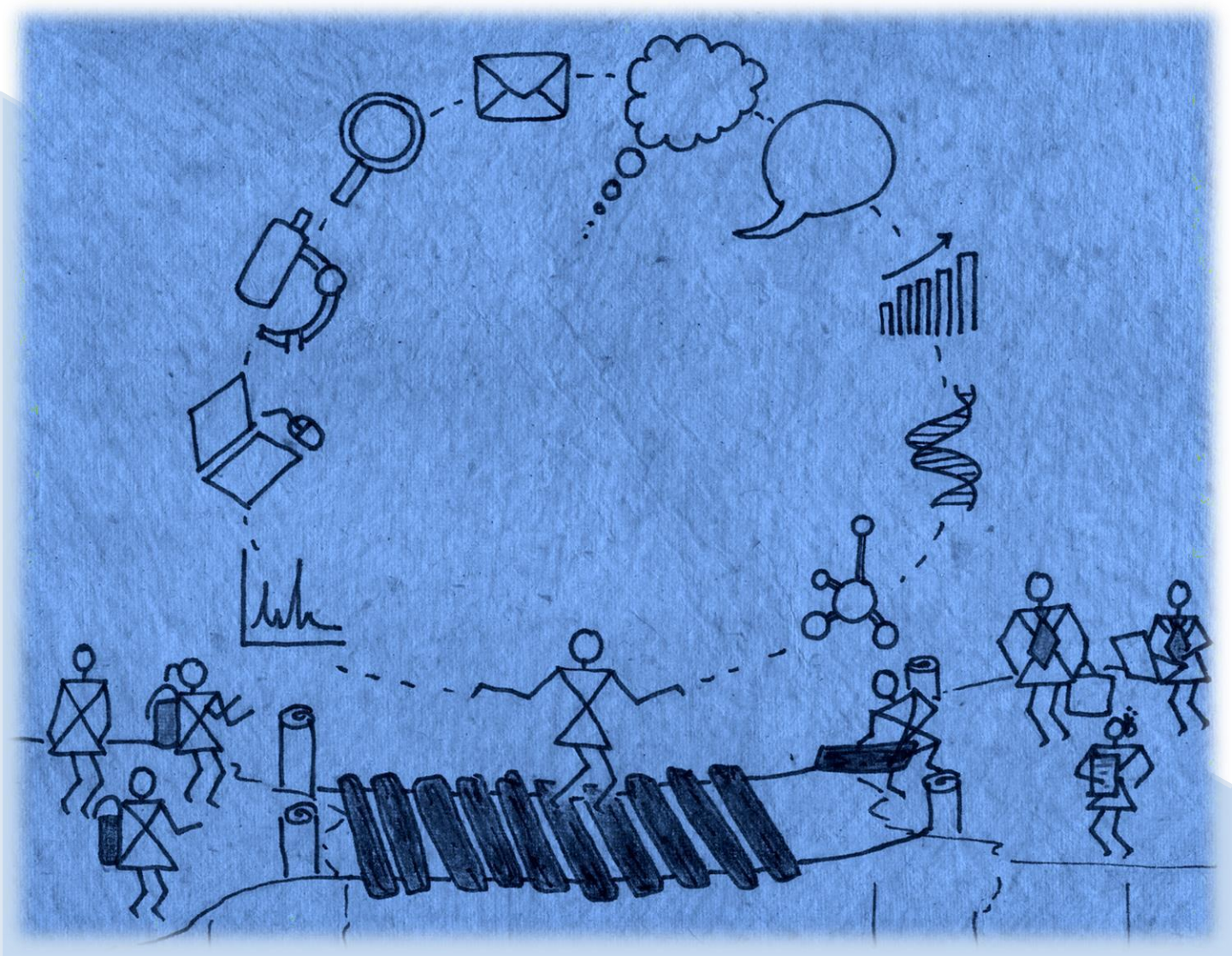
National Chemical Laboratory

CSIR Integrated Skill Initiative

CSIR-NCL SKILL DEVELOPMENT PROGRAM



PREAMBLE

From the Director's Desk.....

Skill development and specific domain knowledge are fundamental to the growth of research, science, technology and in turn, drive the manufacturing & services sectors. India has a large young population with an average age of 29 years and 60% of the total population fall in this age bracket of 30's. However, only 2% of the workforce is skilled in comparison with other countries like the USA, Japan, South Korea, China, Germany and the UK. It is estimated that about 12 million people join the workforce every year to do highly-skilled, semi-skilled and unskilled activities in India. Despite our large population, the skilled worker proportion is low. This deficiency needs to be enhanced through result oriented quality improving programs. Our Hon'ble Prime Minister has appealed, "If we have to promote the development of our country, then our mission has to be 'Skill Development' and 'Skill India'. It necessitates the fast restructuring of the entire learning manpower pool towards skill development which will not only generate a high-quality workforce but will also promote entrepreneurship and technopreneurship in our country. Realizing the importance of skill development in nation-building, the Council of Scientific and Industrial Research (CSIR) in its Platinum Jubilee Year (2016) has launched a significant program – 'CSIR Integrated Skill Initiative'. CSIR is an autonomous body that has surfaced among the finest institutions globally and has contributed significantly to the progress of Scientific and Technological development in the country, along with making contributions in developing high-quality human resources in trans-disciplinary areas.

PREAMBLE

CSIR-National Chemical Laboratory (CSIR-NCL), one of the flagship laboratories of CSIR in chemical science and engineering and allied research fields such as polymers, materials and biochemical sciences, has embarked on implementing the "Integrated Skill Initiative" program by offering various skill development and up-skilling courses for undergraduates, postgraduates and indeed to the youth who remain unemployed even after obtaining a degree.

The workers and industry staff members will also be benefitted from the proposed program. The outline of the program is to bridge the gap between the industries and academia as a whole by enhancing the support towards entrepreneurship and creating a platform for students and professionals working in the industries. The emphasis is to create a robust and sustainable training module of trans-disciplinary nature for skilled workforce generation for industrial requirement.

The "Skill Development Program (SDP)" will undoubtedly provide efficient training, superior analytical skills, communication skills, personality development, leadership, team building mastery of project tools and operation of high-end equipment. In the skill development module, CSIR-NCL offers long term as well as short term courses on nominal charges. The skilling courses are run in CSIR-NCL on the no-loss-no-profit principle along with the availability of decent accommodation facilities for the participants on a token amount. A pool of specialized experts in high technology areas are conducting about thirty courses in various fields. More than five hundred candidates have completed the courses in the areas of chemistry, life sciences and pharmaceutical industry and most of them have been benefitted immensely from this program. I wish all the best to this excellent skill development program and a bright future to the participants.

Dr. Ashish Kishore Lele

Director, CSIR-NCL, Pune

CSIR-NATIONAL CHEMICAL LABORATORY (CSIR-NCL)

National Chemical Laboratory (CSIR-NCL), Pune, established in 1950, is a constituent laboratory of the Council of Scientific and Industrial Research (CSIR). CSIR-NCL is a science and knowledge-based research, development, and consulting organization. It is internationally known for its excellence in scientific research in chemistry and chemical engineering, as well as for its outstanding track record of industrial research involving partnerships with industry from concept to commercialization. The vision of this institute is to advance fundamental knowledge in chemical sciences and engineering to enable Indian chemical and related industries to transform themselves into globally competitive organizations, thus, generating opportunities for wealth creation for the nation and, thereby, enhancing the quality of life for its people. The research fraternity of this institute is broadly divided into six divisions – Biochemical Sciences, Catalysis and Inorganic Chemistry, Chemical Engineering and Process Development, Organic Chemistry, Physical & Materials Chemistry and Polymer Science & Engineering. Apart from well-equipped research laboratories that cater to the disciplines of interest, CSIR-NCL has several individual R&D support facilities, including the Catalyst Pilot Plant, Center for Material Characterization, Central NMR facility, Digital Information, and Knowledge Resources Center, Multipurpose Pilot Plants, National Collection of Industrial Microorganisms and NCL Innovations. In the last couple of years, CSIR-NCL has initiated five Centres of Excellence to encourage and carry out excellent research in specified futuristic areas by bringing together like-minded people through discussions and training staff and students in doing quality research using the best infrastructure and facilities. These include Micro Reactor Engineering, Scientific Computing, Solar Power, Surface Science and Sustainable Polymer Industry through Research Innovation & Training, as well as state of art instrumentation facilities such as the microscopy (confocal, AFM, SEM, ESEM, FESEM, TEM, HRTEM), Mass spectrometry (Orbitrap, Q-TOF, MALDI-ToF, LC-MS), spectroscopy (UV-Vis, UV-Vis-NIR, FTIR, Fluorescence spectrometer, CD spectrophotometer, Raman Spectroscopy), X-ray techniques (Powder X-ray diffraction,

Single Crystal XRD, SAXS) and NMR (Solid-state, solution-state) etc. CSIR-NCL has many collaborative projects with leading academic institutes and industries across India as well as globally. Such partnerships endorse CSIR-NCL's global leadership in chemical and allied sciences. CSIR-NCL has entered into Memorandum of Understandings with several universities and research institutes such as University of Bradford, Tufts University - USA, National Taiwan University, Lund University - Sweden, IIT – Delhi, Security Printing and Mining Corporation of India - New Delhi, Defence Institute of Advanced Technology – Pune, University of Strasbourg under Indo French Centre for the Promotion of Advanced Research (IFCPAR), National University of Singapore , University of Liverpool, University of Toronto , Swedish International Development Agency, ARKEMA FRANCE SA under Indo French Centre for the Promotion of Advanced Research etc. Such partnership endorses CSIR - NCL's global leadership in chemical and allied sciences.

TRAINING CAPABILITIES OF CSIR- NCL

Recognizing the need of skilled and high quality workforce relevant to current and emergent industries, CSIR-NCL proposes to implement a skill development activity under CSIR's Integrated Skill Development Initiative programs by offering a number of skill development and skill upgradation courses to the graduate and postgraduate un-employed youth in addition to the upskilling of industry staffs and workers, scientists, inventors, etc. The main aim of these courses is to create a high-quality skilled workforce in the S&T sector through training/skilling in diverse areas. It further aims to promote entrepreneurship/technopreneurship through skilling, Training of Trainers, and Incubation Center. To train/skill the graduate/postgraduate students, CSIR-NCL proposes to conduct different training modules at CSIR-NCL in diverse areas of Chemical, Biological, and Engineering sectors. The aim of these skill development courses is to give students the opportunity to develop the skills they'll need to prosper "both in their career and beyond". One of the goals of the program is to expose students to career options available and to enhance their chances of employability. The plan further aims to create opportunities, space and scope for the development of the talents of the youth and to expand more of those sectors which have already been put under skill development for the last so many years and also to identify new areas for skill development.

Features of the Program

The main focus is to train youths in such a way that they receive employment and to improve entrepreneurship.

The training programs would be on the lines of international level so that the youths can not only meet the domestic demands but also of other countries like the US, Japan, China, Germany, Russia, and those in West Asia.

The course methodology of this program would be innovative, which would include group discussions, brainstorming sessions, practical experiences, and case studies.

Equal priority to theory classes and practical sessions

Lectures assisted with multimedia aids

Hands-on practice experience

Brief on alternate carrier options

TRAINING CAPABILITIES OF CSIR- NCL

Training/ Skilling for Whom

- Candidates who have just completed their graduation/post-graduation degree course and would like to acquire skills in certain areas in order to get employment.
- Candidates who want to upgrade their knowledge and skills
- Experienced candidates who require ongoing professional development.
- Candidates who desire to improve their knowledge and skills to prepare for a higher level of work/jobs.

Significance and impact/value of Training/skilling Program

The training/skilling initiative of CSIR-NCL is an excellent program not only to take advantage of this unprecedented opportunity of training the students, faculties, scientists, inventors, teachers but also to make an impact of 'Skill India' Mission of Government of India and its subsequent exploration to global communities. The idea is to raise confidence, improve productivity and give direction through proper skill development. Which will enable youths to get employed in the industry. Development of skills, at young age, is essential to channelize them for proper job opportunities. Education, skills development and lifelong learning are the central pillars for employment of workers. It also improve their employability conditions and their living standard and contribute to sustainable business development. Such programs empower people, improve the quality and organization of work, enhance candidate productivity, hikes worker's incomes, improve enterprise competitiveness, and promote job security and social equity, which ensures inclusive and sustainable economic growth, job creation, and social development.

Synthetic Organic Chemistry

About course

Organic synthesis is the toolbox for building molecules impacting every industry, such as pharmaceutical, food, agriculture, polymers and materials, dye, perfumes and cosmetics etc. Synthesizing known molecules via sustainable chemistry as well as new molecules with improved properties greatly impacting the modern society and economy. Practical knowledge on organic synthesis and handling of state of the art facilities is the pre-requirement to contribute to this field. This course provides a hands-on experience of how the planning, designing, execution, and analysis are done in sync to achieve synthetic goals. After completing the course, the candidate will be able to plan and execute the most commonly practiced and advanced organic transformations in lab scale under a safe environment independently.

Course content

Safe practices essential for working with chemicals will be demonstrated along with training on online database tools and literature, analytical data processing and proper record keeping. Various standard aspects of synthetic organic chemistry, e.g. Isolation, extraction & characterization of natural products; Protection & deprotection chemistry; Oxidation & reduction reactions; Moisture and oxygen free (inert) reactions (Grignard, BuLi mediated reactions etc); Asymmetric organo-catalysis and product analysis;
Transition metal catalyzed C-C bond forming reactions (e.g. Suzuzki, Sonogashira couplings) and Peptide synthesis & NMR analysis.

Each of the reactions will be carried out following proper planning and safety requirement, setting up the reactions under direct guidance, monitoring the reaction to completion, isolation and purifications, and analysis of product(s) formed. The experiments and its analysis will be documented for reference.

Industrial Catalysis

About course

Catalysts are the workhorses of chemical transformations in the industry. Approximately 85–90% of the products of chemical industry are made in catalytic processes. A catalyst offers an alternative, energetically favorable mechanism to the noncatalytic reaction, thus enabling processes to be carried out under industrially feasible conditions of pressure and temperature. Main aim of the course is to give in depth knowledge on theory and hand on experience in each aspects of industrial catalysis such as catalyst synthesis; catalyst characterization; catalytic batch reaction, its analysis and catalytic continuous reaction with online product analysis.

Course content

Introduction to catalyst; types of catalysts; homogeneous and heterogeneous catalyst limitations; different types of heterogenous catalysts used in industrial batch and continuous processes; hand on experience in catalyst synthesis; types of synthesis methods and facility used; catalyst formulation; different types of catalyst characterization techniques; type of information generate from each characterization; interpretation of catalyst characterization to establish physico-chemical properties; Hand on experience to carry out catalytic reaction in batch reactor and its analysis in GC/HPLC etc; hand on experience in catalytic reaction in continuous reactor with online feed and product analysis. The course will also extend to add on knowledge in homogeneous catalysis; theory and hand on experience in computational chemistry.

Quality Control Chemist

About course

Quality control aspect is an essential part to ensure the desired quality of the products being manufactured. Hence role and responsibilities of a Quality Control Chemist becomes crucial in any manufacturing as well as in research unit. Quality control of any product can be assured by qualitative and quantitative research methods. In any organization quality assurance unit implements the quality control with the help of team of quality control chemists. During such exercise the quality control chemists prepares lists of tests to be performed and their sample size. Maintaining raw data and its documentation is very essential in such exercise. Quality control has to be enforced from material entry phase to the level of finished product as per the established standard Operative Procedures of the organization. Tests to ensure the quality can vary from organization to organization however basic laboratory tests are integral part of such quality control programme.

Course content

Basic principles of analytical instruments used in research laboratory or manufacturing unit, Summarization of application of each analytical instrument

Operation of pH meter, conductivity meter, analytical weighing balance and infrared Fourier-transform infrared (FT-IR) spectrometer

Operation and maintenance of centrifuge, autoclave, thin layer and gas chromatography (GC) instrument chromatography (TLC) chamber, high performance liquid chromatography (HPLC) instrument

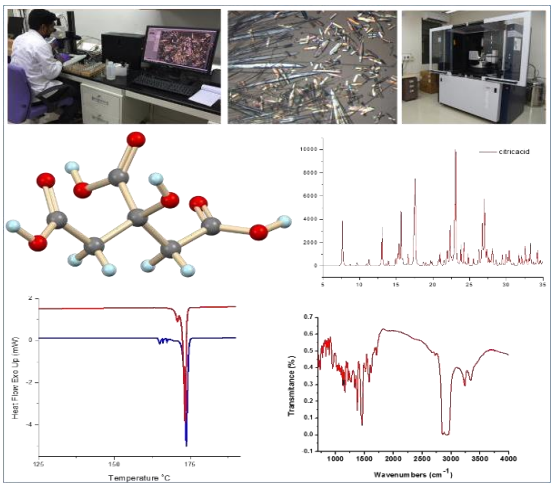
Operation and demonstration of TEM,SEM and mass spectrometry assays

Demonstration of good documentation practice (GDP) and data integrity while reporting and documentation as per standard operating procedures (SOP) and good laboratory practices (GLP)

Drug Polymorphism and Pharmaceutical Cocrystals

About course

Polymorphs, salts, hydrates, solvates and cocrystals are gaining tremendous importance in pharmaceutical industries because of their ability to modify physicochemical and pharmacological properties of APIs (Active Pharmaceutical Ingredients) which enhances their therapeutic efficacy. Therefore, pharmaceutical companies are focused on screening for APIs for polymorphism and the development aspects of novel salts/cocrystals that include physicochemical characterization scale up, processing and formulations of these materials. This necessities the requirement of proper training course for the employees involved in the characterization, and formulation of pharmaceutical solids as well as to the post graduate students of Chemistry, Life Science and Pharmacy who can explore job opportunities after attending the proposed course. This course was envisaged and planned keeping in view the need of the pharmaceutical industry for the trained and skilled manpower for polymorph and cocrystal screening of APIs and the development aspects of these novel solid forms.

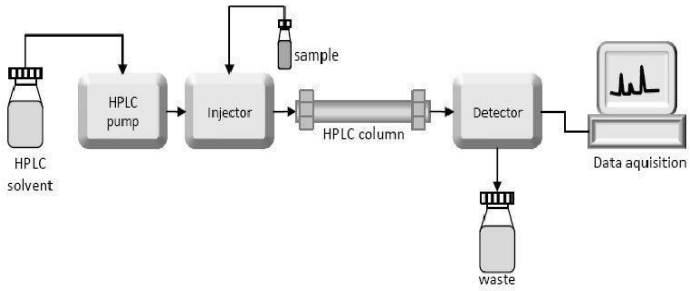


Course content

Introduction to Different Solid Forms, Solid-state Properties of Pharmaceutical Solids, Theory and Principles of Polymorphic Systems, Cocrystals and Salts, Crystal Engineering and Supramolecular Chemistry, Salt and Cocrystal Design of Pharmaceutical Solids, Salt Selection, Methods of Preparation of Polymorphs, Hydrates, Solvates, Salts and Cocrystals, Polymorphs, Salt and Cocrystal Screening, Thermodynamics of Different Solid Forms, Structural Aspects of Different Solid Forms, Characterization Methods for Polymorphs, Salts and Cocrystals (SCXRD, PXRD, DSC/TGA, Raman, IR, NMR, etc.), Solid-state Phase Transformations, Crystal Structure Analysis, Regulatory Aspects of Polymorphs, Salts and Cocrystals.

High Performance Liquid Chromatography (HPLC)
Liquid Chromatography-Mass Spectrometry (LC-MS)

Schematic HPLC System

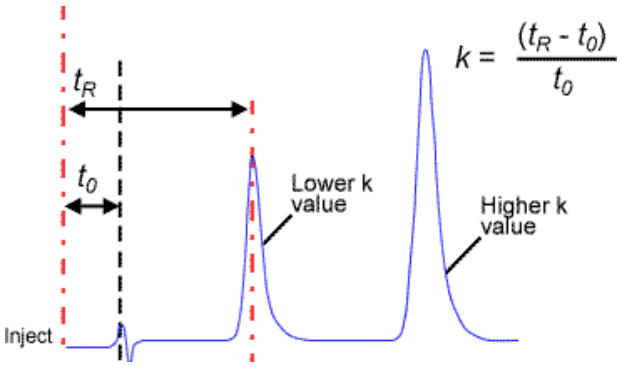


About course

Course will cover the Principles and Basic Theory of Chromatography, HPLC Instrumentation, Method Development, Method Validation and Learning of HPLC Software with hands-on training on Running Samples, Data acquisition, Quantitation, Report generation, etc. and the course also cover the Principle and Basic Theory of Mass Spectrometry, Instrumentation and Learning of data acquisition and data analysis Software This training also covers technical aspects on day to day Maintenance and Troubleshooting.

Course content

The course will cover learning Principles, Basic Theory, Instrumentation and Applications of Liquid Chromatography and Mass Spectrometry. It also includes HPLC Method Development, Validation, Quantitative analysis and Report generation.



Gas Chromatography (GC), Gas Chromatography-Mass Spectrometry (GC-MS)

About course

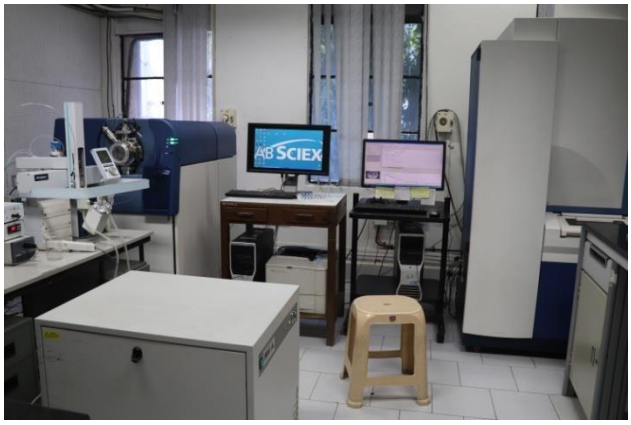
These are powerful techniques for the identification and characterization of organic compounds, bio-molecules, Agricultural Fertilizers, industrial gaseous samples as well as Impurity profiling, etc. This course deals with basics to various applications such as reaction moniterisation, Headspace Sample Analysis, Qualitative and Quantitative analysis.

Course content

Introduction to GC, primary GC Components, GC software, data cquisition, qualitative and quantitative sample analysis, report generation, GC troubleshooting and maintenance.

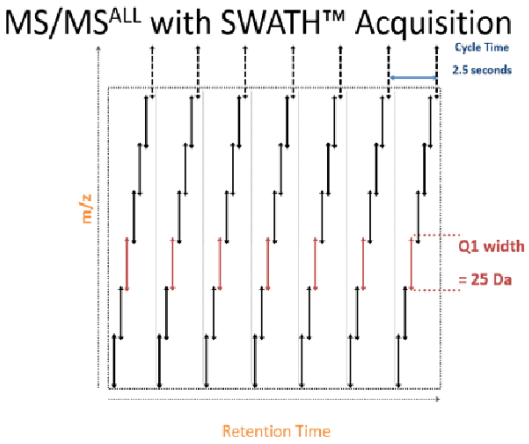
Introduction to GC-MS, pre-acquisition software, data acquisition software, integration report generation, Librar search concepts, sample preparation techniques/ extraction techniques with an interactive demonstration, maintains of GC-MS instrument and troubleshooting the problems. Introduction to Headspace GC-MS.

SWATH-MS based Proteomics



About course

Sequential Window Acquisition of all Theoretical mass spectra (SWATH-MS), is a label free data independent acquisition method for relative and absolute quantification of proteins. It has become a powerful tool in the area of mass spectrometry based proteomics

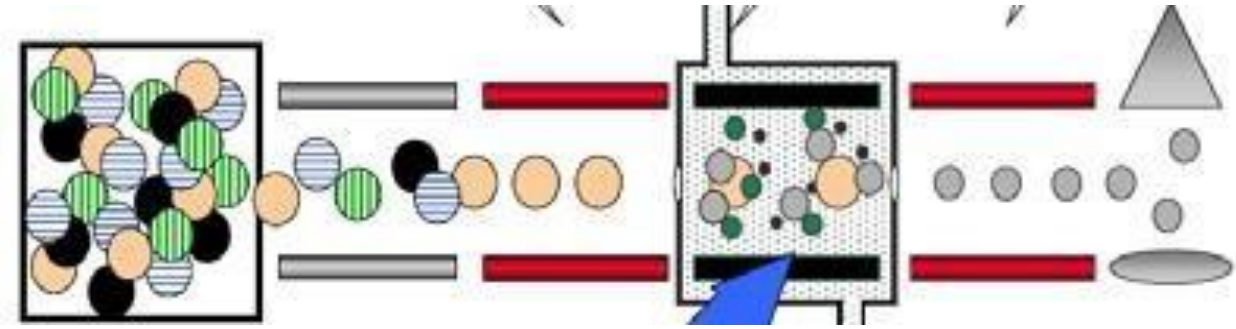


Course content

This course deals with

- Sample preparation for SWATH-MS.
- Development of mass spectral library by information dependent acquisition for SWATH based quantification.
- SWATH acquisition.
- Analysis of SWATH-MS data.

Targeted Proteomics

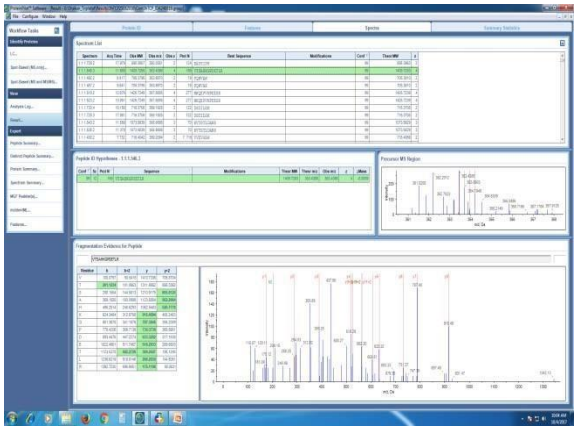


About course

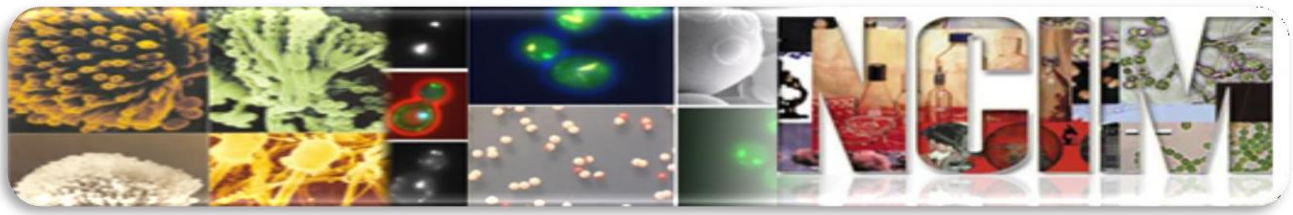
Multiple reaction monitoring (MRM) based targeted quantification is becoming quite popular in the proteomics community, as this approach is able to replace expensive antibody-based quantification like Western blotting and ELISA. MRM performed on QTOFs and Orbitraps are called parallel reaction monitoring (PRM). In PRM, post mass spectral acquisition, extracted ion chromatograms (XIC) for selected ions are used for quantitation. The high scan speed facilitates development of sequential window acquisition of all theoretical mass spectra (SWATH). In this approach, peptides are quantitated by targeted data extraction of SWATH-MS data.

Course content

- This course deals with
- Sample preparation.
- Development of mass spectral library by information dependent acquisition for SWATH based quantification.
- MRM/PRM/ SWATH acquisition.
- Analysis of data.



Microbial Identification by Biochemical, Genetic and Genomic Techniques



About course

Microbial identification is important in all fields of microbiology and life sciences disciplines like food, water, air, soil, remediation, biomedical etc.

Course mainly designed for researchers in academia and industries. It will cover basic to advanced techniques used in microbial identification.

Course content

- Phenotypic identification (Biochemical and Protein based) using VITEK-2 and VITEK-MS methods
- Genetic identification by Sanger Sequencing and phylogenetic analysis.
- Genomic identification by Whole genome sequencing of bacteria and basic bioinformatic analysis

Controlled Release of Active Molecules : Hands on Preparation, Characterization and Release Studies of Active Molecules

About course

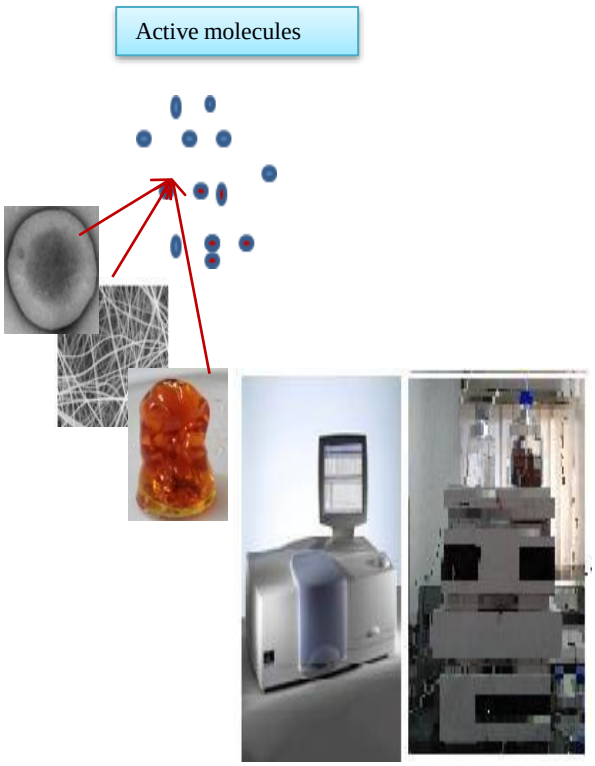
Active molecules (pesticides, drugs, , nutrients, perfumes, detergents, proteins pesticides, drugs, peptides, etc.) when exposed to unfavorable conditions may become unstable, inactive and vary the physical or chemical properties. To avoid these effects and to maintain the shelf life of the active molecules an inert supporting material is essential. This supporting material could be based on polymer or a inorganic materials or combination of both. Depending on the stability of the active molecules, the matrices and encapsulation in macro, micro and nano forms can be designed. In this workshop we describe the methods involved in preparation, characterization and analysis of the matrices and encapsulates. And also demonstrate methods to estimate the qualitative analysis of active molecules.

Course content

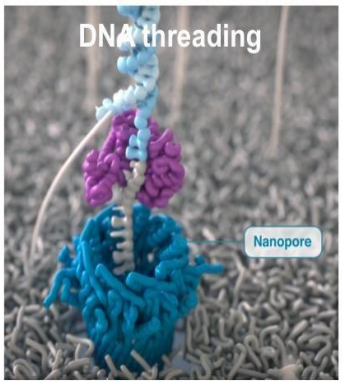
HPLC, MS, UV-visible spectrophotometer, FTIR spectroscopy, electrospinning unit, and optical microscope (instruments as mentioned will be used for demonstration)

For whom: Industry sponsored candidates, entrepreneurs, students with science and biotechnology background.

Possible job opportunities: Consumer, agriculture, Pharma industries, academics,
R & D labs and entrepreneurs.



Oxford Nanopore Sequencing and Data Analysis (ONS)



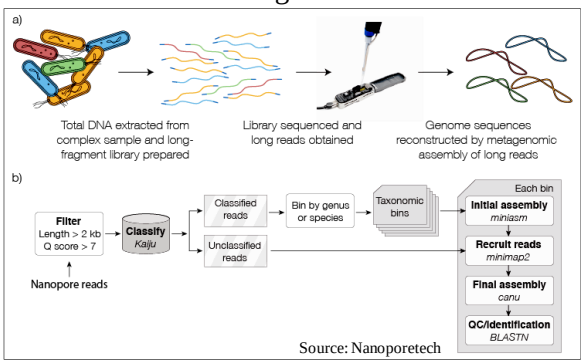
About the course

Technologies for sequencing DNA have been developed rapidly in the past decade. Although, the traditional Sanger sequencing method is still widely used, the Next Generation Sequencing technologies have completely revolutionized the DNA/RNA sequencing and its applications. The Oxford Nanopore sequencing technology is a third generation sequencing technology, and uses simplified instrumentation to rapidly generate long read DNA sequences. It is currently the only method that can facilitates direct DNA and RNA sequencing in real time.

Course content

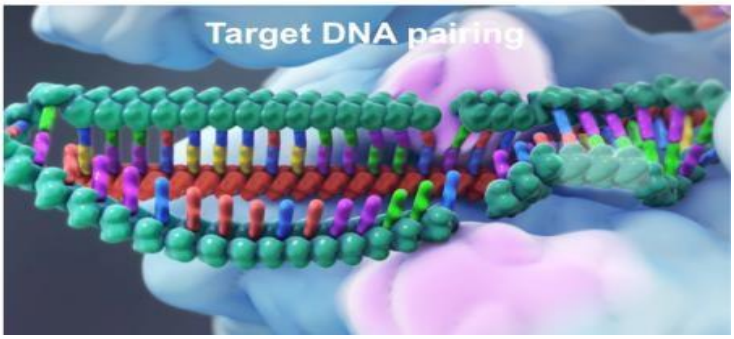
The aim of this workshop/course is to familiarize the participants with the fundamentals of the Next Generation Sequencing technologies, with special emphasis on Oxford Nanopore sequencing technology, and provide hands-on training on complete sequencing of *Escherichia coli* genome and analysis of the sequence data. During the workshop, participants will be familiarized with the Oxford Nanopore sequencing method and the basics of data analysis.

Metagenomics



Source: Nanoporetech

CRISPR/Cas9 Genome Editing in Mammalian and Bacterial Cells (CGE)

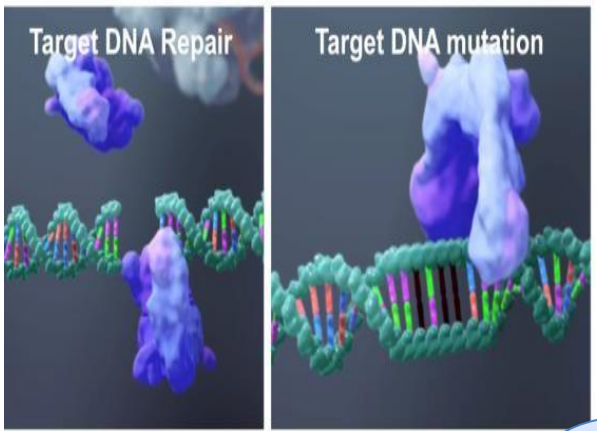


About course

The rapid developments in sequencing technology has provided a deeper understanding of a variety of genomes spanning the entire spectrum of life from prokaryotes to eukaryotes. Concomitantly, techniques for targeted manipulation of genomic sequence (genome editing) in living organisms has also evolved considerably. While DNA recombination based techniques were widely used for genome editing for many years, recently the CRISPR method has revolutionized genome editing by making it simple, quick and precise. Thus, CRISPR based genome editing methods have huge potential in academic and industrial R&D.

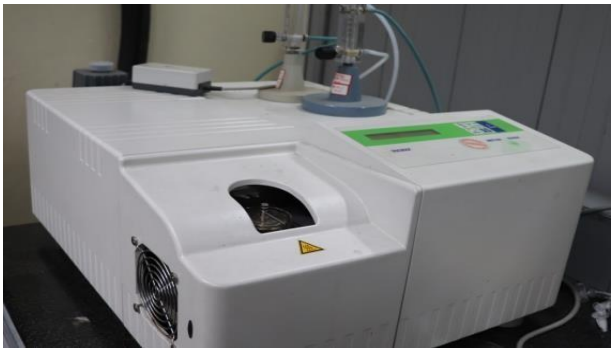
Course content

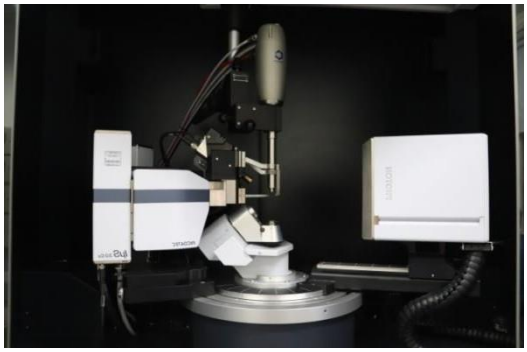
Introduction to CRISPR based genome editing methods and details of protocols used in mammalian and bacterial genomes, hands on training in conducting CRISPR/Cas9 editing in mammalian (CHO) and bacterial (*E. coli*) cells, and confirmatory phenotyping and genotyping the CRISPR edited genomes.



Source: Nature.com

Materials Characterization Techniques





About course

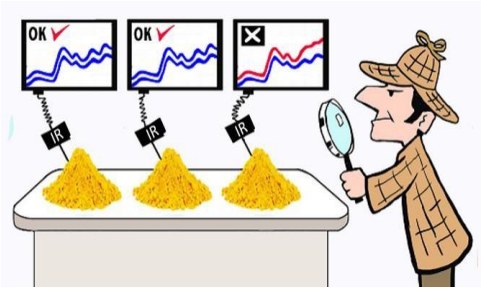
Materials Characterization Techniques' include the principles of widely used advanced surface and structural characterization techniques for material identification, structure elucidation, quality assurance, contamination control, and process improvement, etc. Using various material characterization techniques, one can analyze and distinguish all materials, or combinations of materials, in use today—whether they are metals, ceramics, polymers, nanomaterial, semiconductors, or composites. To understand a materials structure and its correlation with properties and its application in the technological process requires accurate and precise structural information. The proposed course will impart training/skilling on the characterization of the materials using modern techniques. The course will focus on the interrelationships and interdependence between processing, structure, properties, and performance.

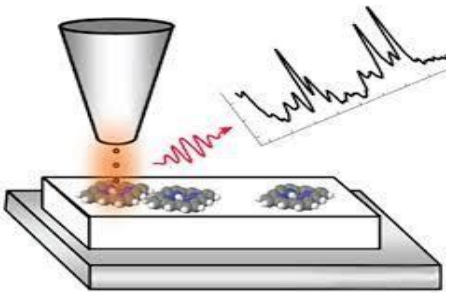
Course content

The course will cover the characterization of materials using sophisticated instruments that includes,

- Nuclear Magnetic Resonance (NMR) spectrometer
- Fourier Transform Infrared Spectrometer (FTIR)
- Raman Spectrometer
- X-ray photoelectron spectroscopy (XPS)/Electron Spectroscopy for Chemical Analysis (ESCA)
- Transmission/Scanning Electron Microscopy (TEM, SEM) and Optical Microscopy,
- X-ray Diffraction (Powder and a Single Crystal)
- Vibrating Sample Magnetometer (VSM),
- Thermal Methods such as DSC/TGA,
- UV-Vis Spectrophotometer
- Mass Spectrometer

Basic to Advanced Training in Infrared (IR) Spectroscopy



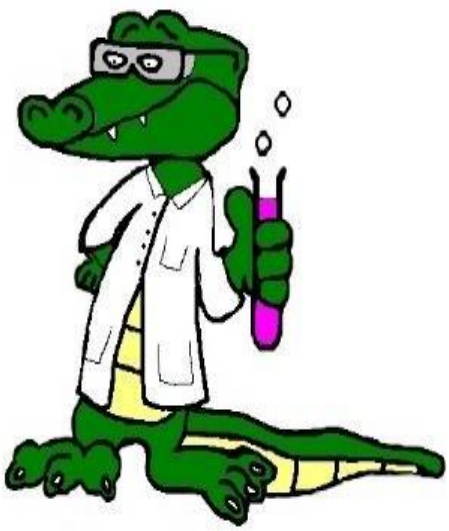


About course

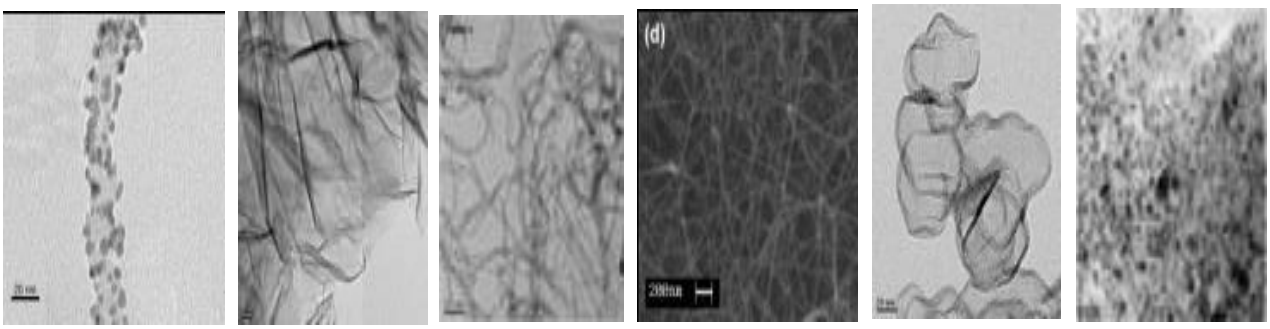
Infrared (IR) spectroscopy is an extremely powerful tool to characterize the functional groups in molecules. IR spectroscopy is widely used in industry as well as in academic research. It is a simple and reliable technique for measurement, quality control and dynamic measurement. It is also employed in forensic analysis - in civil and criminal analysis. In this course, we will learn about IR spectroscopy – from the basic principles to data analysis. Hands on training of recording IR spectra using a spectrometer in the solid as well as liquid samples will be provided. Furthermore, methods of analysis (baseline subtraction, curve-fitting, multi-peak fitting, deconvolution, etc.) of the IR spectra will be discussed. Hands on training on the same will be provided on training data-sets. After completing the course the candidate will be able to record, analyse, and interpret the IR spectra independently..

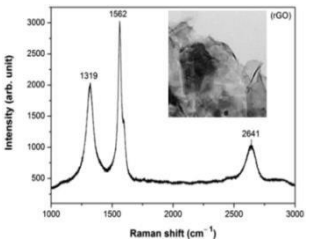
Course content

Basic principles of IR spectroscopy, Lambert-Beer law, operating principles of IR spectrometer, demo of IR spectrometer, recording IR spectra (hands on training), methods of IR spectral analysis (baseline subtraction, curve-fitting) on training data-sets, multi-peak fitting, line-shape analysis, deconvolution, advanced concepts and applications.



Raman Spectroscopic Measurements





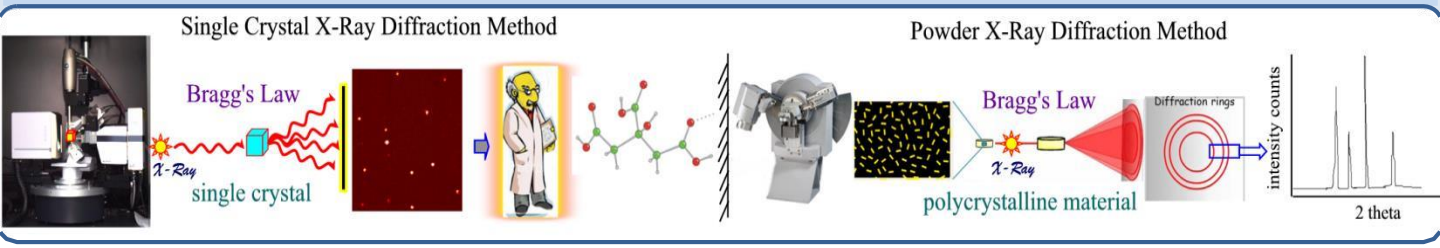
About course

This course is intended for the students, faculty and industry personnel who wish to acquire the practical knowledge of Raman spectroscopic measurement technique. The Raman spectroscopy is extensively used to understand the nature of bonding, structural disorder, crystallinity, and to study the effects of physical and chemical stresses on materials' properties. It offers a precise spectral fingerprint, unique to a molecule or molecular structure. Further, it is a non-destructive measurement technique with ease of sampling. Raman measurements are very useful in all sectors of industries – nanomaterials, semiconductors, polymers, life science, petrochemical, agrochemical, pharmaceuticals and dyes, etc.

Course content

- Introduction to Spectroscopic Measurements
- Basics of Raman Spectroscopy and its Applications
- Instrumentation – Raman Spectrometer
- Sample Preparation Techniques
- Standard Measurements
- Characterization of Materials – Carbon Nanotubes, Graphene, Graphene Oxide, Metal Oxide Nanomaterials, Polymers and Composites
- Hands-on Experience with Raman Spectrometer

X-Ray Crystallography



About course

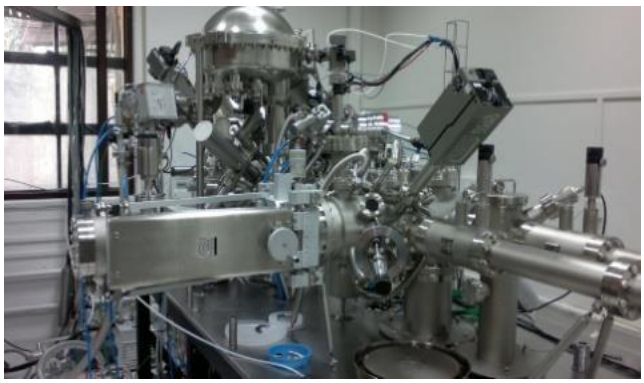
X-ray crystallography is the most powerful method for determining accurate crystal structures of small as well as macromolecules. The properties of any crystalline material are very much functions of its crystal structure and internal arrangement of atoms. X-ray diffraction is a sophisticated method to determine crystal structure and related parameters. This course provides a glimpse of how X-ray diffraction can be used to solve various crystallographic problems of both single and poly crystalline materials, starting from an elementary level. In this course, both single crystal and powder X-ray diffraction methods will be covered. After completing the course the candidate will be able to analyse and interpret the diffraction data and will acquire sufficient expertise to solve and refine the crystal structure independently.

Course content

Coordinate systems in crystallography, Crystal symmetry, Point groups, space groups, Miller indices, X-ray diffraction and Bragg's law, Reciprocal lattice, Scattering factor, Ewald sphere, Friedel's law, Space group determination from diffraction data, Fourier transformation, Electron density equation and map, Structure factor, Thermal parameters, Background theory for data collection, Data reduction, Interpretation of intensity data, The phase problem, Crystal structure solution and refinement, Determination of absolute and relative configuration of chiral crystals, Crystal structure analysis, CIF preparation, validation and deposition to CSD, Data collection using three and four-circle diffractometer, Area detectors, Different methods of crystallization, Crystal selection to structure refinement (hands on training), Introduction to powder diffraction, Indexing powder pattern, Particle size determination, Wide-angle and Small-angle X-ray Diffraction, etc.

Insitu Surface technique for material Characterization: XPS (ESCA)

Pressure gap



About course

X-ray Photoelectron Spectroscopy (XPS) also known as Electron Spectroscopy for Chemical Analysis (ESCA) is the most widely used surface analysis technique for characterizing solid materials because it can be applied to a broad range of materials and provides valuable quantitative and chemical state information from the surface of the material being studied. The average depth of analysis for an XPS measurement is approximately 8-10 nm which makes it highly surface specific. This course provides the evolution of XPS from a mere surface technique to a powerful *insitu* technique for studying materials under close to working conditions. The course will also provide lab visit and practical demonstration of how sample analysis is carried out in a conventional spectrometer.

Course content

•Introduction to Photoelectron Spectroscopy, instrumentation, x-ray sources, synchrotron radiation, qualitative and quantitative analysis using XPS, depth profiling, mapping etc

• Near Ambient Pressure XPS (NAPXPS), instrumentation, bridging the pressure gap, applications and examples

•Lab visit, demonstration on sample preparation, sample loading and data collection

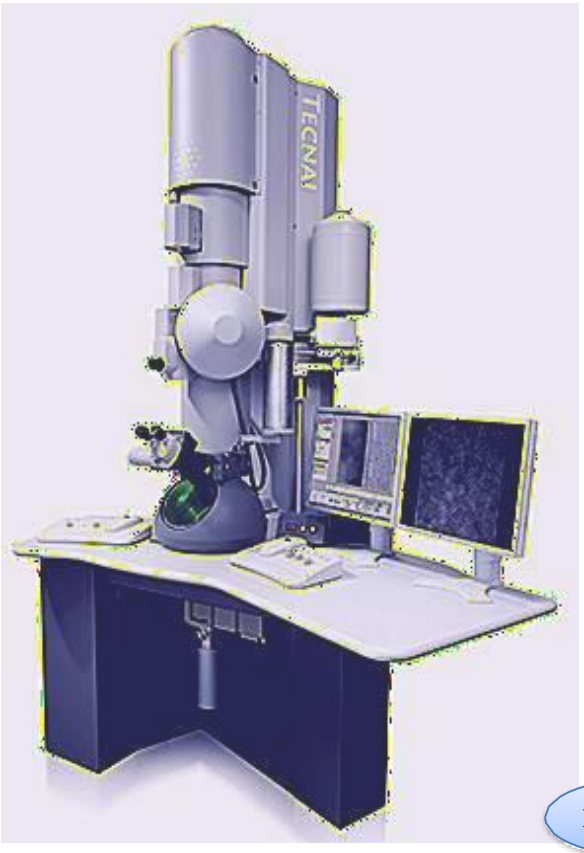
Electron Microscopy Analyst

About course

Electron Microscopy is a fast evolving research tool in several advancing fields of science including, materials science, solid state physics, metallurgy including coating, corrosion, biology, pharmaceutical and formulation industries, dye and paint industry, polymer industries etc., specifically in the domain of nano science and nanotechnology. Particularly recent developments in the highly resolvable electron microscopy such as STEM, cryo-TEM, Environmental SEM enables a researcher to get the best information, for instance, details about lattice fringes, atomic positions at subnano meter scales and ability to analyse bio-samples at a near life conditions. Extended analyses such as EDS enables with high definition elemental

Course content

Introduction to electromagnetic radiation with matter and electron microscopy, Scanning Electron Microscopy: Theoretical and practical aspects, Transmission Electron Microscopy:
Theoretical and practical aspects, Advanced electron microscopic techniques, Associated techniques viz., EDS, SAED, elemental mapping etc., Applications of electron microscopy in research and industry, Case studies. Practical exposure to various electron microscopes (SEM, TEM) including
(i) sample preparation, (ii) data acquisition (iii) data Analysis and (iv) data interpretation.



Polymer Characterisation by DSC, TGA and GPC Spectrophotometer

About course

Thermal Analysis and chromatography are used in a various industries like polymer, pharmaceutical, food, materials etc. Thermo Gravimetric Analysis (TGA), Differential Scanning Calorimeter (DSC) and Gel Permeation Chromatography (GPC) is the essential and important laboratory techniques used for material characterization. GPC is the most powerful method for determining average molecular weight and polydispersity of polymer samples. DSC and TGA is used to find out melting/crystallization point, decomposition temperature of polymers. This course provides a glimpse of size exclusion Chromatography technique, GPC and thermal techniques, DSC and TGA. After completing the course the candidate will be able to analysis and interpret the data and will acquire sufficient expertise.

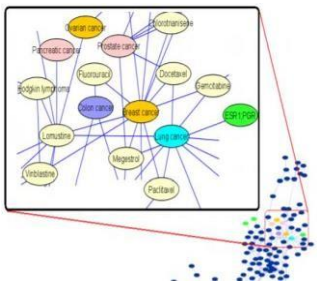
Course content

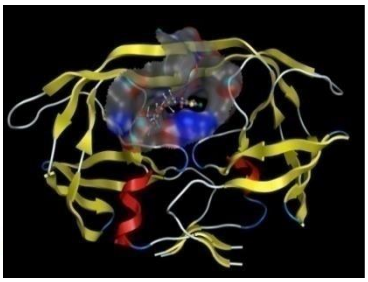
GPC - Introduction to GPC Technique, History and development, Pump, Column and detectors, Sample method development, live demonstration of sample run, Analysis and troubleshooting, etc.

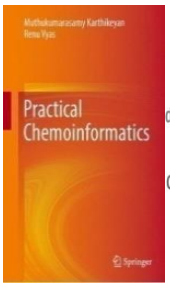
DSC - Introduction to DSC , different components of the system, melting and crystallization point, glass transition temperature, heat of fusion and heat of crystallization , determination of purity, liquid crystal transitions, hands on practical sessions, analysis of results and use of software, troubleshooting

TGA - Introduction to TGA, different components of the system, determination of filler percentage, decomposition temperature, activation energy, hands on practical sessions, analysis of results and use of software, troubleshooting, etc.

Chemoinformatics







About course

Chemoinformatics is equipped to impact our life in a big way mainly in the fields of chemical, medical and material sciences. This certificate course is a product of several years of experience and passion for the subject to attract the interest of the student community who wish to pursue chemoinformatics as a career. The topics chosen cover the entire spectrum of chemoinformatics activities (methods, data and tools). The algorithms, open source databases, tutorials supporting theory using standard datasets, guidelines, questions and do it yourself exercises will make it valuable to the academic research community. At the same time every section of the training devotes a section on development of new software tools relevant for the growing pharmaceutical, fine chemicals and life sciences industry..

Course content

Introduction to Chemoinformatics: Aims, Scope. Role of Chemoinformatics in Pharmaceutical/Chemical Research: Chemical Structure Representation: 1D, 2D and 3D Structures and Molecular Descriptors (1D, 2D and 3D) , Molecular Similarity and Molecular Diversity Analysis. Introduction to Similarity Metrics: Chemical Databases – Design, Storage and Retrieval methods , Clustering and Statistical Methods for Molecular Informatics ,Quantitative Structure Activity/Property/Toxicity Relationship Studies, Introduction to Molecular Properties, Activities and Toxicities , Reagents and Products based Combinatorial Library Generation , Computational Investigation of Chemical Reactivity, Pharmacophore Modeling, Docking Studies (Protein-Ligand), Target Selection, Active Site Analysis, Ligand Preparation and Conformational Analysis, Rigid and Flexible Docking, Structure based Design of Lead Compounds, Library Docking, Future Perspectives in Chemoinformatics

Reference:**Practical Chemoinformatics** , M.Karthikeyan, Springer (2014)

Industrial Polymer Processing and Rheology

About course

In today's age, polymer processing and polymer rheology are extremely important in that a knowledge in these two areas is required to understand how the commercial polymers produced in several million tons/year will be converted in useful products that find applications in areas from household to space-age and defense applications. This course will try and expand theoretical knowledge of students in these two areas into a more practical and industry oriented teaching that is not possible in college/university-based classrooms. The students taking this course can expect to be upgraded in practical aspects of polymer processing and rheology but with firm roots in the theory base as well.

Course content

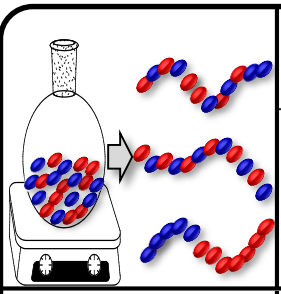
The course will consist the following content:

1. Theory of Rheology
2. Rheometry
3. Linking rheology to macromolecular architecture
4. Lab sessions on rheometry, data interpretation and problem solving
5. Basics of various processing techniques
6. Plastics compounding & formulation
7. Industry visits to polymer processing and other ancillary industries.

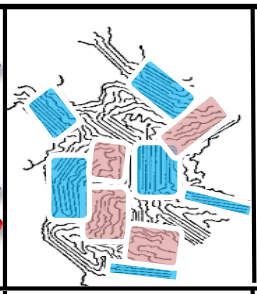
Capillary Rheometer

DSM Microcompounder

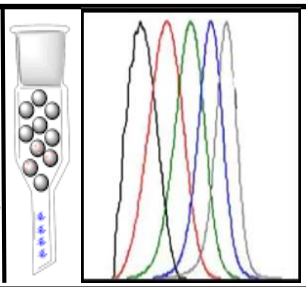
Polymer Synthesis and their Structure-Property Relations



Polymer Synthesis

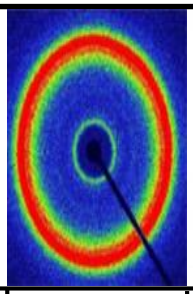


Micro-structure

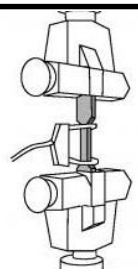


Molecular weight

Viscosity



X-ray diffraction



Tensile

About course

Polymers are useful material for the mankind in many ways, it is difficult to imagine life without polymers. The polymers are synthesized by various techniques, the properties of the polymer can be altered or tailored while synthesizing the polymer. Hence synthesis and its structure-property relation is very important.

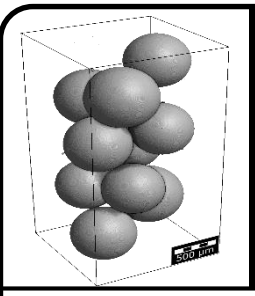
In this course fundamental polymerization techniques such as solution polymerization and suspension polymerization will be demonstrated and their properties such as viscosity, molecular weight, tensile strength, crystallinity and particle size will be studied.

Course content

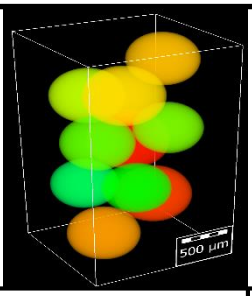
The course will consist the following content:

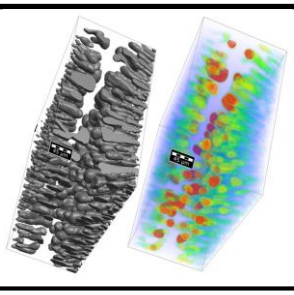
1. Polymer synthesis : free radical solution polymerization, suspension polymerization.
2. Characterizations: Gel permeation chromatography, viscosity, Tensile strength and X-ray diffraction.

3D X-ray Microscopy

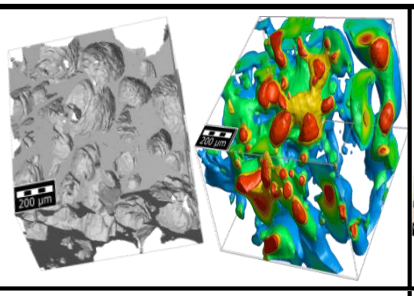


Micro-spheres

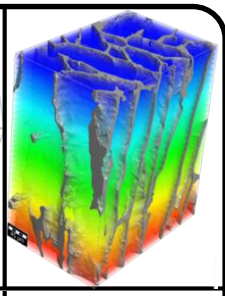




Micro-structure of Hollow Fiber



3D Visualization of Void Volume



Numerical Solver

About course

X-ray microscopy (XRM) is a non-destructive three-dimensional imaging technique, based on the principles of computed tomography, which has gained significant importance in many different research areas in chemical and physical sciences, biology, pharma, geology, archaeology, and engineering. The aim of this certificate course is to introduce the technique to students and professionals, encompassing its fundamentals and applications. Course comprises of lecture sessions, practical sessions and laboratory demonstrations, with more focus on tomography data analysis and interpretations. Upon completion, the participants are expected to be familiar with 3D X-ray image acquisition process, potential and advantages of XRM over other microscopy techniques and in silico numerical solvers.

Course content

The course will consist the following content:

X-ray image acquisition, reconstruction, artefacts, noise suppression, segmentation, image analysis, case studies on battery research and additive manufacturing, exposure to 3D numerical solvers and in situ or 4D imaging.

Embedded Systems

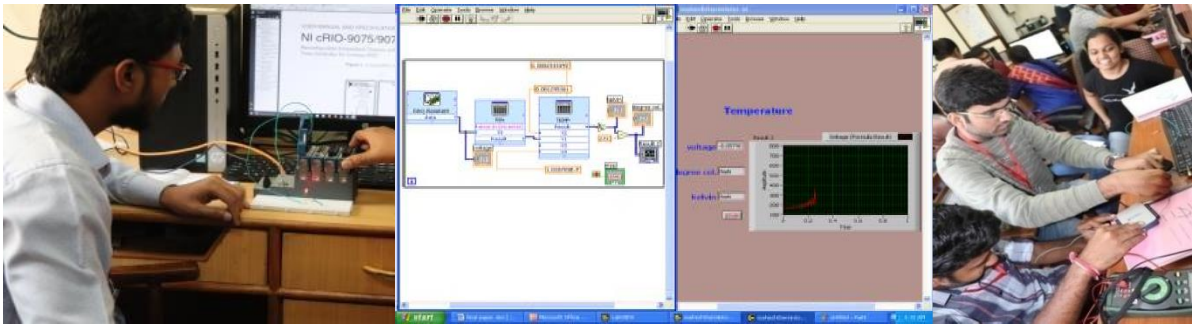
About course

Forthcoming Industry 4.0 and today's digital world need not only basic Embedded Systems knowledge with hardware, interfaces and software development but also ARM based developments for Automation, IOT and Cyber Physical Systems developments. Course will be highly useful for career in Industry and for academia.

Course content

Intelligent and hand held systems which are real time systems have become a part of our day-to-day life. There is a paucity of embedded engineers to work in industries and for academia. This course knowledge and hands on experience will be highly useful for Electronic, Instrumentation, Computer, Mechanical and IT engineers to go ahead in their career. The output of this intelligent course will be always exponential. Course includes - 8051 microcontroller architecture and hands on using assembly programming and OPCODES for IO ports, on chip RAM, on chip timers, memory mapped IO, IO mapped IO, external memory and PPI interface, 8255 PPI interface and programming, LCD and keyboard interface, stepper motor controller, hardware and software interrupts – hand on using stepper motor and opto couplers, LEDS and on chip timers, serial RS232 communication using PC hyper terminal, introduction to "C", hands on and Embedded "C", 32 bit RISC microcontroller ARM7 LPC2148 architecture, hands on using embedded C programming and down loading on training board and developed hardware using flash utilities, System On Chip (SOC) architecture

LabVIEW Basics and Applications



About course

Laboratory Virtual Instrumentation Engineering Workbench (LabVIEW). Engineering Workbench, by National Instruments is a system-design platform and development environment for a graphical language – visual programming language, LabVIEW is commonly used for data acquisition, instrument control, and industrial automation on a variety of platforms like intelligence and interfaces incorporated in Test & Measurement instruments, intelligent instrumentation. Experience in LabVIEW based developments and in testing & maintenance is highly acknowledged. globally To be at par with global trends and technology and for Industry 4.0, Cyber Physical Systems, acquaintance and then proficiency in LabVIEW is desirable for engineers in Academia and Industry. This course is 100% hands on course.

Course content

Why LabVIEW, basic logic development using "C" programming, concept of parallel programming using LabVIEW instead of using multi core CPUs, LabVIEW graphical development system, virtual instrumentation approach, hands on includes - Front Panel / Block Diagram, Toolbar /Tools Palette, wires, data types, variables, connector panel, math in LabVIEW, data flow programming, Components of a LabVIEW Application - Creating a VI, Data Flow Execution, Additional Help - Finding Functions, debugging techniques, context help window, elements of typical program, clusters, loop, how to make decisions, Getting Data into your Computer- Data Acquisition Devices - NI-DAQ, concept of PC add on cards and addressing, PC add on and USB ADDA card, image acquisition card, Communication protocols – RS232, USB, GPIB/IEE488, introduction to cDAQ and C modules., cRIO and LabVIEW RT.

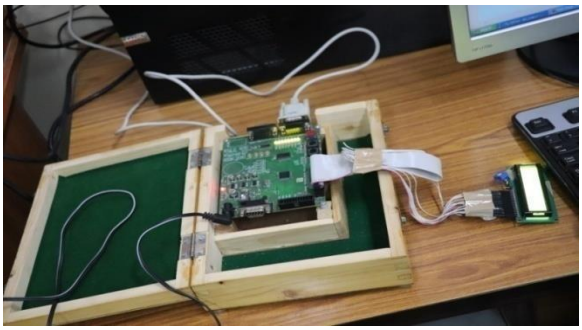
Advance Training on ARM Controllers

About course

Forthcoming Industry 4.0 and today's digital world need not only basic Embedded Systems knowledge with hardware, interfaces and software development but also ARM based developments for Automation, IOT and Cyber Physical Systems developments. Course will be highly useful for career in Industry and for academia.

Course content

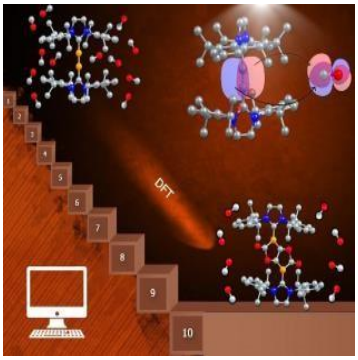
Intelligent and hand held systems which are real time systems have become a part of our day-to-day life. There is a paucity of embedded engineers to work in industries and for academia. This course knowledge and hands on experience will be highly useful for Electronic, Instrumentation, Computer, Mechanical and IT engineers to go ahead in their career. The output of this intelligent course will be always exponential. Course includes - 8051 microcontroller architecture and hands on using assembly programming and OPCODES for IO ports, on chip RAM, on chip timers, memory mapped IO, IO mapped IO, external memory and PPI interface, 8255 PPI interface and programming, LCD and keyboard interface, stepper motor controller, hardware and software interrupts – hand on using stepper motor and opto couplers, LEDS and on chip timers, serial RS232 communication using PC hyper terminal, introduction to "C", hands on and Embedded "C", 32 bit RISC microcontroller ARM7 LPC2148 architecture, hands on using embedded C programming and down loading on training board and developed hardware using flash

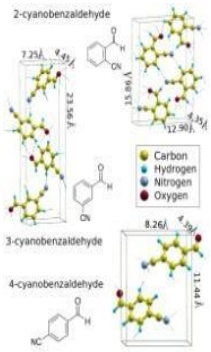


Introduction to Scientific Computing

About course

Theory and Computation form two pillars of science today, with the third pillar being experiments. In the quest of understanding nature, we as scientists represent or model the system of interest so that we understand how it functions, and also predict and design new molecules or materials. The system of interest could be as diverse as understanding the atomistic details of catalysts to design a better catalyst or representing biological processes to design therapeutics.



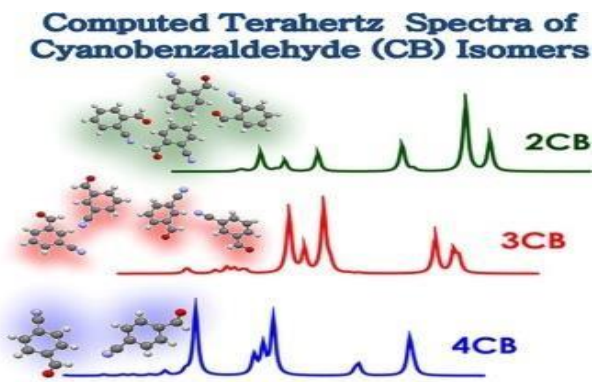


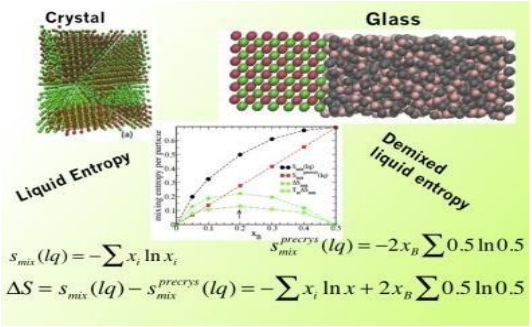
Course content

There will be six independent sessions to provide a bird's eye view of a wide spectrum of methodologies ranging from DFT to techniques like Molecular Dynamics and Machine Learning.

Some of the topics that will be discussed are noted below.

- Understanding catalysis through simulations with Density Functional Theory
- Insights from atomistic and Coarse-grain simulations in soft and biological matter
- Application of statistical mechanics to soft condensed matter
- Systems Biology and Large Scale Biological Pathway Analysis using different Computational Techniques
- Methods to learn from large data





Certificate Course on Science Communication and Practice

About course

Science is one of the major and most important tool for survival and a strong pillar of every nation. It supports technology, living standards, encourages continuous improvement, elevates critical thinking and more, thus making its role important. Evidence based, society-connect, appropriate channels for communication, language, diversity, clarity etc. are few parameters that strengthen science communication. Advancement of society not only depends on education, mind-set but influencing factors like knowledge, scientific temperament, innovative learning pattern etc. It is important to communicate science to non scientific audiences and students to transform individuals towards greater understanding, stay informed, to create a harnessing environment, inculcate values, elevate progress, educate, build ethics, scientific temperament and science knowledge to encourage decision making at all fronts. Thus, science communication programs have become a tool to train students for developing effective communication skills. Government bodies and institutions are supporting communication of science for public understanding, and provided opportunities to students interested to choose science communication as a career. Depending on the individual interests, careers vary from freelance reporting, editing, proof reading, advertising, authoring, video making, news writing, practicing, etc. The course @ CSIR-NCL is part of the skill development program, which aims to train and enhance individual skills.

Course content

Course-I: Introduction to Science Communication
Course-II: Writing Science News
Course-III: Communicating with Social Media
Course-IV: Philosophy of Science
Course-V: Communicate using Social Media
Course-VI : Podcasts
Course-VII: How to Write Science Papers
Course-VIII: Evidence, Ethics and Controversies
Course-IX: Insights and Case Studies

Objective:

• Enhance skills on science writing, effectively disseminate information on developments in science and technology, facilitate greater synergy between communicators, scientists, and policymakers
•Gain confidence in developing science stories, provide ethics & evidence based guidelines
• Provide insights, discuss case studies
• Project proposal writing

Patents for Students, Researchers & Entrepreneurs

About course

The recent National Intellectual Property Rights Policy by Department of Industrial Policy and Promotion, Government of India has clearly stated the importance of Intellectual Property Rights (IPR) in realizing and enabling sharing of the social and economic benefits of novel innovations with citizens of the nation. The policy strongly encourages researchers in public funded academic and R&D institutions in IPR creation by linking it with research funding & career progression. Also, the President of India has declared this decade as the Decade of Innovations. In accordance with national focus, this course provides basic understanding of patents for students and researchers to enable them to make the best use of the patenting system. They learn how to seek protection for themselves(or their organization's) inventions, secure rights in various jurisdictions and license/ commercialize patents.This course is a 5 days training program ending with the participants receiving a Certificate of Completion.

Course content

Introduction to intellectual property, more specifically, patents, parts of a patent document, identifying inventions, carrying out preliminary searches using free patent databases to understand patent landscape, patentability etc., integrating IP with research, drafting complete specification, filing patent applications and prosecution, protecting inventions outside India, PCT applications, foreign filings, patent enforcement, infringement, and commercialization- patent licensing. Hands on practice - patent search and drafting.

Food Safety and Quality Assessment

About course

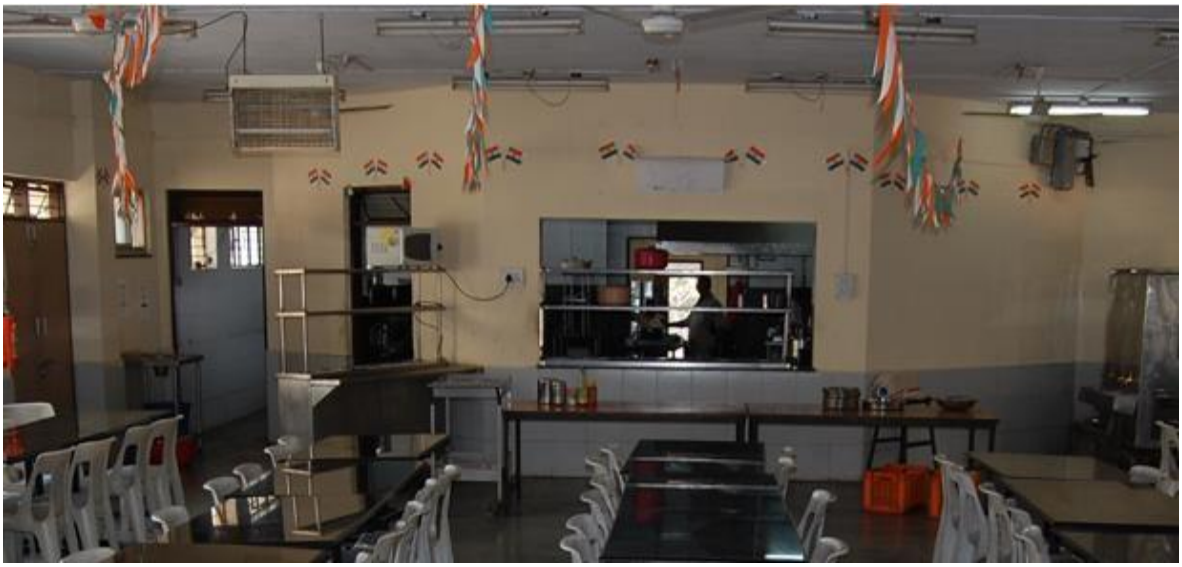
The recent National Intellectual Property Rights Policy by Department of Industrial Policy and Promotion, Government of India has clearly stated the importance of Intellectual Property Rights (IPR) in realizing and enabling sharing of the social and economic benefits of novel innovations with citizens of the nation. The policy strongly encourages researchers in public funded academic and R&D institutions in IPR creation by linking it with research funding & career progression. Also, the President of India has declared this decade as the Decade of Innovations. In accordance with national focus, this course provides basic understanding of patents for students and researchers to enable them to make the best use of the patenting system. They learn how to seek protection for themselves(or their organization's) inventions, secure rights in various jurisdictions and license/ commercialize patents.This course is a 5 days training program ending with the participants receiving a Certificate of Completion.

Course content

Introduction to intellectual property, more specifically, patents, parts of a patent document, identifying inventions, carrying out preliminary searches using free patent databases to understand patent landscape, patentability etc., integrating IP with research, drafting complete specification, filing patent applications and prosecution, protecting inventions outside India, PCT applications, foreign filings, patent enforcement, infringement, and commercialization- patent licensing. Hands on practice - patent search and drafting.

Accommodation

Course participants will be provided accommodation at NCL Campus subject to the availability.
Accommodation fee (for complete course period plus two days extra):
Rs. 500/- for students.
Rs. 1000/- for others.
(Course fee includes breakfast, tea and lunch)
For any clarification please contact:
CSIR - NCL SDP Coordinator, CMC Division, First Floor
CSIR-National Chemical Laboratory, Dr. Homi Bhabha Road
Pune- 411 008, India
Phone: 020-25903013, 25902225
Email: ncl.sdtc.ncl@csir.res.in



Registration Guidelines

- Select the course from the course list, which you wish to attend/enroll.
- Click on Apply, and complete the registration process.
- You will be notified by email if you are shortlisted to attend the course..
- Click on the link given in the email to set the password for your profile.
- For accessing your profile, your email id will be your login.
- Make a Demand draft (DD) for your course fee, which should be made in favor of **"Director, NCL"** and payable at Pune. Please make sure that the DD is valid for at least **one month** from the start date of the course.
- After accessing into your profile, fill the DD details, upload scanned copy of your DD and complete the final submission.
- After verifying the course fee details, you will be further notified by email for your enrollment in the course. You will be able to take the printout of your application thereafter.
- Send the printout of the application, original DD, other documents to **''CSIR - NCL SDP Coordinator, CMC Division, First Floor, CSIR-National Chemical Laboratory, Dr. Homi Bhabha Road, Pune- 411 008, India''** by speed post or registered post. It should reach NCL within **two weeks** from the start date of the course.
- You can directly reach NCL to attend the course as per the given dates.
- Course fee once paid would be non-refundable.
- Course fee would be accepted only by DD; any other mode would attract the rejection of the candidate to attend the course.
- For any further query or issue, please contact with CSIR - NCL SDP Team as per the details below:

CSIR-National Chemical Laboratory
Dr. Homi Bhabha Road
Pune - 411008
Phone: 020-25902296, 25902225
Email: ncl.sdtc@ncl.res.in

Course Feedback

X-ray Crystallography

The practical and the theory part held perfectly. Very interactive and helpful nature of instructor helped us lots in the learning process. One can go from basic symmetry to advance X-ray crystallography and PXRD. This program helped me lots to improve my skill in single crystal as well as in powder X-ray. I highly recommend this course for researchers working in the area of crystallography of small molecules and material science.

- Hemant Singh

Equal focus on the practical as well as theory part. Beneficial for those who do work with crystals. The course structure was very well planned and the instructor took the course from basics (introduction of symmetry, formulas and techniques applied behind structure solving) to advance levels (dealing with XRD machine, software and solving the crystal structures). Good efforts were made by the instructor (Dr. Gonnade) and his student (Dr. Ekta sangtani) in enhancing student's learning ability. Accommodation and food were also good.

-Himanshi

Basic to advance Industrial microbiology

They taught us from all basis to advance techniques. The trainer gives us full support all my doubts were cleared. They give us all hands on techniques. This course was very helpful for me.

- Kruti Rana

The faculty of NCL were very generous with their knowledge and helpfulness. This experience not only taught us about new diagnostic, tools but fundamentals are of microbiology are very clear to me now. Keep up the good work!

- Krishna Preeti

Course Feedback

Mass Spectrometry and Proteomics Techniques

This course covers basics of proteomics and also covered practical approach. Practical approach, hand on training really helped to understand software part. I would like to suggest that increase the time period of the course from 15 days to 20-25 days, which would help participants to explore more about software.

-Mrunali Deshmukh

The training met the stated objectives and will surely help me in my future goals. The trainer's knowledge was good. Questions were answered fully the training was enjoyable and well organized. It covered what I expected it to.

- Asyasha Hasan

Patent Certificate Course on Patents

The course held by NCL on the topic of patent, was really great we got so much useful information, that will help in our future and research work. Thank you arranging such a great course for us. Hoping for more Courses like this so we can take useful knowledge.

-JayeshShankar Waghmare

Want to thank you for conducting SDP programme. Many of my doubts were cleared. The content of the programme was nicely designed and the speakers gave a great insight about the topics. The best topics related to patents were dealt. The best part of the programme is there is an assignment related to topic at the end of the session which brings out the best in us.Mam looking forward for your next advanced session on this.

-Suryakala Goda

Photo book

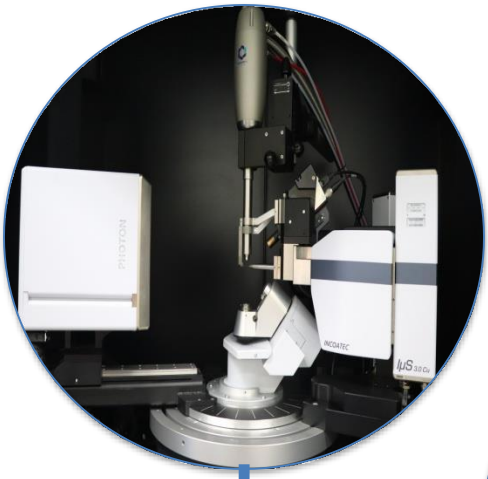
Overview

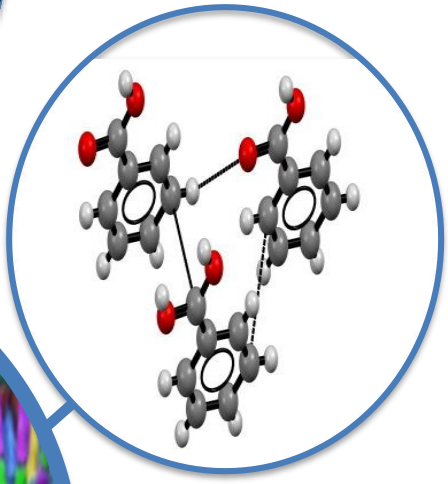
CSIR-National Chemical Laboratory (CSIR-NCL), Pune is a science and knowledge based research, development and consulting organization and one of the premier chemical research laboratories in India under the flagship of Council of Scientific and Industrial Research (CSIR). CSIR-NCL has embarked on implementing "Skill India" mission of the Government of India and has initiated the CSIR's Integrated Skill Initiative program by offering number of skill development and skill upgradation courses to the graduate and postgraduate un-employed youth in addition to the industry staffs and workers. The main aim of these courses is to create the high-quality skilled workforce relevant to current and emerging industry need in the S&T sector through training/skilling in diverse areas at different National Skill Qualification Framework (NSQF). It further aims at promoting entrepreneurship through skilling, Training of Trainers and Incubation centre.

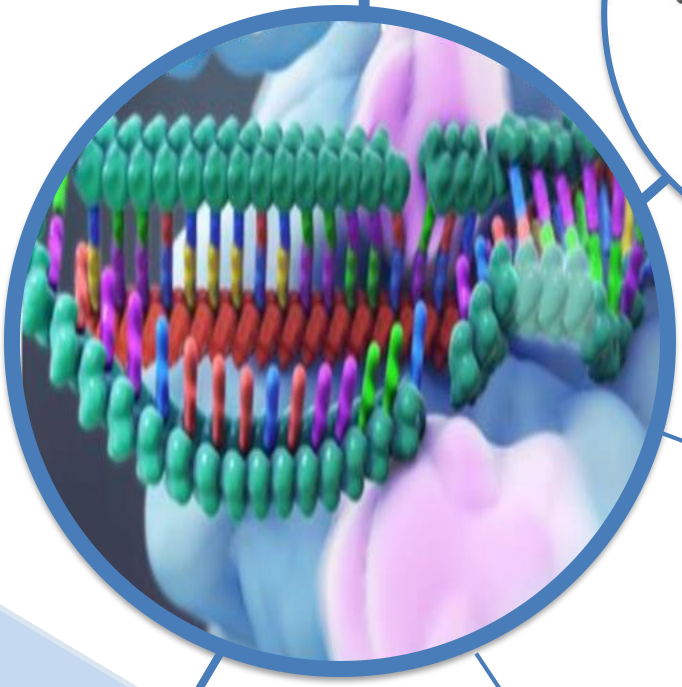
Announcement

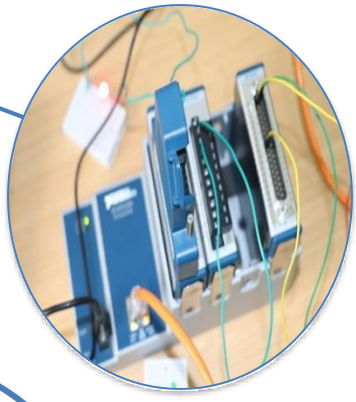
Documents

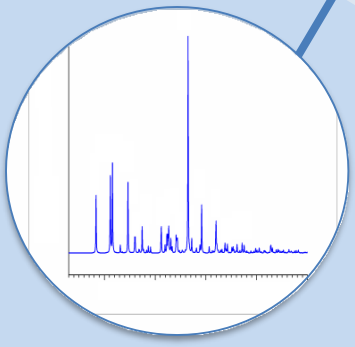
- NOC_College
- NOC_Employer











Contact us

CSIR- National Chemical Laboratory Dr. Homi Bhabha Road
Pune-411008, India

Website: http://nclsdp.ncl.res.in/

Email: ncl.sdtc@ncl.res.in