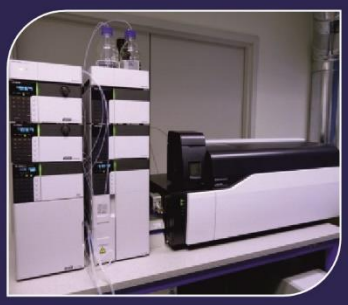
# Insight and Hands on Training on

# X-ray and Chromatography based Techniques for Academic & Industrial Innovations

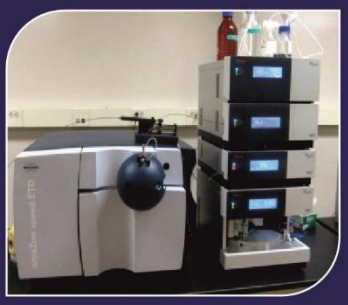
**[National Mission for Accelerating Growth of New India's Innovation (AGNI)]**

**27th May to 3rd June 2022**







**Under the aegis of**

**SYNERGISTIC TRAINING PROGRAM UTILIZING THE SCIENTIFIC AND TECHNOLOGICAL INFRASTRUCTURE (STUTI)**

**Organized by**

**Department of Chemistry and**
**Center of Advanced Studies**
**&**
**Sophisticated Analytical Instrumentation Facility (SAIF)/**
**Central Instrumentation Laboratory (CIL)**
**Panjab University, Chandigarh**

**Website: stuti.puchd.ac.in**

विज्ञान एवं प्रौद्योगिकी विभाग
DEPARTMENT OF
SCIENCE & TECHNOLOGY

Azadi Ka Amrit Mahotsav

# PROGRAM SCHEDULE

## 7 DAY TRAINING PROGRAM

### X-Ray and CHROMATOGRAPHIC Based TECHNIQUES for Academic & Industrial Innovations

**National Mission for Accelerating Growth of New India's Innovation (AGNI)**

Under the aegis of

SYNERGISTIC TRAINING PROGRAM UTILIZING THE SCIENTIFIC AND TECHNOLOGICAL INFRASTRUCTURE (STUTI)

**Chief Patron**
**Prof. Raj Kumar**
Vice Chancellor
Panjab University

**Chief Guest**
**Prof. Amitava Patra**
Director
INST, Mohali

**Chief Guest**
**Er. S.S. Kohli**
Scientist G/Adviser & Head
R & D Infrastructure Division, DST

**Chief of Honor**
**Prof. Renu Vig**
DUI, Panjab University

Organized by

**DEPARTMENT OF CHEMISTRY**
**&**
**SAIF/CIL, PANJAB UNIVERSITY, CHANDIGARH**

MAY 27, 2022 | **10.30 AM ONWARDS** | SAIF **SEMINAR** HALL

# INAUGURATION

| | |
|---|---|
| **Venue** | **Seminar Hall, CIL, Panjab University, Chandigarh** |
| **10.30 AM** | **Welcome** |
| **10.32 AM** | **PU ANTHEM** |
| **10.35 AM** | **WELCOME ADDRESS**<br><br>Prof. Sonal Singhal<br>Chairperson Dept. of Chemistry, Panjab University |
| **10.40 AM** | **INTRODUCTION TO TRANINIG PROGRAM**<br><br>Dr. Rohit K. Sharma<br>Workshop Convenor, Dept. of Chemistry, Panjab University |
| **10.45 AM** | **INTRODUCTION-DST STUTI SCHEME**<br><br>Prof. G.R. Chaudhary<br>Director SAIF/CIL Panjab University |
| **11.00 AM** | **UNVEILING OF WORKSHOP BOOKLET** |
| **11.05 AM** | **ADDRESS BY GUEST OF HONOUR**<br><br>Prof. Renu Vig<br>Dean of University Instruction, Panjab University |
| **11.15AM** | **INAUGURAL ADDRESS BY CHIEF GUEST**<br><br>Prof. Amitava Patra<br>Director, Institute of Nano Science and Technology, Mohali |
| **11.25 AM** | **HONOURING THE DIGNITARIES** |
| **11.27 AM** | **VOTE OF THANKS**<br>(Dr. Savita Chaudhary)<br>Organizing member, Dept. of Chemistry, Panjab Univer |
| **10.29 AM** | **NATIONAL ANTHEM** |
| **10.30 AM** | **Tea** |

**Professor Raj Kumar**
*Vice Chancellor*

**PANJAB UNIVERSITY**
**CHANDIGARH, *India* 160 014**

# MESSAGE

A warm welcome to all the participants of the Tanning program on "X-ray and Chromatography based Techniques for Academic & Industrial Innovations" (National Mission for Accelerating Growth of New India's Innovation (AGNI))" under the aegis of Synergistic Training program Utilizing the Scientific and Technological Infrastructure (STUTI) initiative of Department of Science and Technology (DST) at Panjab University. This is truly a platform which aims to sensitize the young generation about the state-of-the –art equipments through open access Science and Technology infrastructure across the country.

I congratulate the Sophisticated Analytical Facility (SAIF)/Central Instrumentation Laboratory (CIL), Panjab University, Chandigarh for being selected as the Project Management Unit (PMU) and exquisitely executing their role as the hub manager for the STUTI program in the region. The Department of Chemistry & Center of Advanced Studies, Panjab University, must be commended for taking the initiative of hosting this hand on training program. It is heartening to see interdisciplinary amalgamation wherein the organizers collaborate as one team.

The strength of X-ray and Chromatography based Techniques are extensively used by researchers for academics and industrial applications. Chromatography plays a vital role in the chemical industry for the testing of samples for purity. The programme enables the separation, identification, and purification of the components. Therefore, the theme of the training program is quite relevant and is in line with the National Mission for Accelerating Growth of New India's Innovation (AGNI).

The endeavor of the organizing committee will be fruitful accomplishment. I wish the event great success.

(Raj Kumar)

**Prof. Renu Vig**
Dean of University Instruction,
Panjab University

पंजाब विश्वविद्यालय
चंडीगढ़, भारत-160014
PANJAB UNIVERSITY
CHANDIGARH
INDIA-160014

# MESSAGE

It is a matter of honour for me to extend a very warm welcome to all the dignitaries and gathered here for the Hands on Training Program on "X-ray and Chromatography based Techniques for Academic & Industrial Innovations" (National Mission for Accelerating Growth of New India's Innovation (AGNI))" being organized by SAIF/CIL and Department of Chemistry & Center of Advanced Studies, Panjab University, Chandigarh.

The research in Chemical science is highly essential coordinate in creating new molecules of drugs, inorganic components and it also offers new molecules of vaccines for the treatments of various dreadful diseases. With an aim at creating the much needed perspectives and expertise in constantly evolving trends and practices in X-ray and Chromatography based Techniques. The current hands on training program could undoubtedly be another milestone in DST's initiative towards building human resources through STUTI.

This training program will also encourage the researchers and industry to provide suitable solutions and interface for future scientific ventures. This will also provide tremendous opportunities for all the stakeholders to come together, collaborate and complement each other.

I congratulate the Coordinators and the Organizing Committee for having worked hard o ensures the success of the 7 day training program at the Panjab university campus.

I wish you all a happy and successful conference.

(Renu Vig)

Scientist G/Adviser & Head
R & D Infrastructure Division

Department of Science & Technology
Government of India

Department of Science and Technology
Ministry of Science and Technology

## Er. S.S. Kohli

# MESSAGE

Dear Participants,

Greetings

I am overwhelmed with the success of STUTI program so far. The real motive of the Scheme 'Synergistic raining program Utilizing the Scientific and Technological Infrastructure' (STUTI) is intended to build human resource and its knowledge capacity through open access S&T Infrastructure has been thoroughly achieved through these training program.. As a complement to the various schemes of DST funding for expansion of R&D Infrastructure at academic institutions, STUTI scheme think about a hands-on training program and sensitization of the state-of-the-art equipment as well as towards sharing while ensuring transparent access of S&T facilities.

This training program will impart practical hands-on training on sophisticated instruments. I strongly feel that after going through this program on 'X-ray and Chromatography based Techniques for Academic & Industrial Innovations" (National Mission for Accelerating Growth of New India's Innovation (AGNI))". The current hands on training program could undoubtedly be another milestone in DST's initiative towards building human resources through STUTI.

I congratulate the Coordinators and the Organizing Committee for having worked hard o ensures the success of the 7 day training program at the Panjab university campus.

I wish you all a happy and successful conference.

(Er. S.S. Kohli)

# Sophisticated Analytical Instrumentation Facility

Panjab University, Chandigarh-160 014 (INDIA)
(Established under the Panjab University Act VII of 1947 enacted by the Govt. of India)

*Director*

Ref. No. SAIF/.....

**MESSAGE**

## MESSAGE

Dear Participants,

Greetings from SAIF, PU, Chandigarh.

I feel delighted on occasion of STUTI training program. This DST scheme envisions hands on training programs and sensitization of the state-of-the-art equipment as well as towards sharing while ensuring transparent access of S&T facilities. Sophisticated Analytical Instrumentation Facility (SAIF) Panjab University feel proud to be part of this program. Our department is always striving for prompt services and quality analysis to support researchers from academia, R&D labs and industries from all over India.

The centre houses 25 state-of art analytical instruments with high upkeep time; workshop facilities to repair analytical instruments and postgraduate courses like M.Tech. (Instrumentation) and M.Sc (Instrumentation).

This training program will impart practical hands-on training on sophisticated instruments. I strongly feel that after going through this program on 'X-ray and Chromatography based Techniques for Academic & Industrial Innovations" (National Mission for Accelerating Growth of New India's Innovation (AGNI))", the participants will be able to use these instruments more effectively in their research. This will not only improve the quality of research but also help in optimum utilization of instrumentation facilities at their institutes.
With best wishes

**(Prof. G R Chaudhary)**

**Prof. Sonal Singhal**
Chairperson

**DEPARTMENT OF CHEMISTRY**
**AND**
**CENTRE OF ADVANCED STUDIES IN CHEMISTRY**
**PANJAB UNIVERSITY, CHANDIGARH - 160 014, INDIA**

# MESSAGE

Dear Participants,

It is my proud privilege to welcome you all to one of the oldest and most prestigious institutions of North India – the Department of Chemistry & Center of Advanced Studies, Panjab University, Chandigarh for the purpose of participating in the 7-day training programme on X-ray and Chromatography based Techniques for Academic & Industrial Innovations" (National Mission for Accelerating Growth of New India's Innovation (AGNI))", being organized under the aegis of STUTI in collaboration with SAIF/CIL, Panjab University.

Advanced X-ray and Chromatography based Techniques have become an indispensable prerequisite to understand the insight of most chemical problems in the present times. These techniques help in understanding the nature of bonding in various types of molecules, as well as the programme enables the separation, identification, and purification of the components of a mixture for qualitative and quantitative analysis using HPLC, GC, LC-MS.

The extensive use of X-ray and Chromatography based Techniques in modern day drug discovery, research and development as well as molecular interactions, called for organizing a training program that would help students and researchers in multidisciplinary fields to gain a better understanding of advanced methods in chemical sciences. This training program will focus on advanced and updated X-ray and Chromatography based Techniques most relevant to the current scenario, which I am sure would be helpful in honing the skills required in the field of research and development.

In addition to our colleagues at SAIF/CIL, a sustained assistance from our motivated faculty members, students and staff at the Department of Chemistry has made this programme possible. I extend my sincere thanks to all for their cooperation, support and hard work.

(Chairperson)

**Dr. Rohit Kumar Sharma**
Workshop Convenor

**DEPARTMENT OF CHEMISTRY &**
**CENTRE OF ADVANCED STUDIES IN CHEMISTRY**
**PANJAB UNIVERSITY, CHANDIGARH - 160 014, INDIA**

# MESSAGE

On behalf of the organizing Committee, it is an honour and pleasure to officially welcome you to the Training Program.

The Training program encompasses key aspects X-ray and Chromatography based methods that are used extensively in modern day new molecules discovery, research and development and diagnostics. This field overlaps with other areas of biology and material science, particularly drug discovery. It concerns itself with understanding the nature of bonding and their purity during synthesis. This training program will primarily help the participants who are seeking basic and advanced level training in XRD and chromatographic techniques to get insight into their research and other industrial based technical operations. The training program enhances the working horizon among faculty, Post-doc fellow, PhD Fellow. The scope of the training program is also extended to the industrial persons who are extensively involved in new molecules production and their detailed qualitative and quantitative descriptions. This training program will play a vital role in understanding formations, actions, and regulations of various novel molecules that can be used to efficiently target new drugs.

This puts light on the increasing importance of on the hands-on training on X-ray techniques including Single crystal diffraction, powder XRD, SAXS, WDXRF for the qualitative and quantitative analysis. Chromatography plays a vital role in the chemical industry for the testing of samples for purity. The programme enables the separation, identification, and purification of the components of a mixture for qualitative and quantitative analysis using HPLC, GC, LC-MS. In this scenario, organizing such a workshop would help the emerging students and researchers in multidisciplinary fields to gain a better understanding of basic methods in chemistry.

We hope that this training program will stimulate new ideas and approaches for promoting chemistry and enhance skills in the field. We wish all delegates a fruitful attendance and involvement in the excellent event and hope that this training program is productive. Thank you for your participation and we wish you a very enjoyable stay in Chandigarh.

(Rohit Kumar Sharma)

# PANJAB UNIVERSITY, CHANDIGARH

Since its inception in 1882 at Lahore (now in Pakistan), the magnificent traditions of the Panjab University have been a source of inspiration for the current generations of the faculty and students to accomplish and stand out in their academic endeavors. This University now ranks 1st among Universities of India and 38th in Asia according to Times Higher Education Asian University rankings 2015. It has been ranked number one university in India and in the bracket 276-300 internationally in the Times Higher Education World University Rankings, 2014-2015 powered by Thomson Reuters and it is also ranked 39th by the Times Higher Education among BRICS & Emerging Economies.

The Panjab University Campus at Chandigarh accommodates 73 teaching and research departments/institutes/centres besides four independent Chairs for research. Furthermore, the university has 189 affiliated/constituent colleges spread over Punjab and Chandigarh besides Regional Centres at Muktsar, Ludhiana, Hoshiarpur and Kauni. In addition, there is the Vishveshawaranand Vishwa Bandhu Institute of Sanskrit and Indological Studies at Hoshiarpur. Panjab University is located in Sector 14 and Sector 25 of Chandigarh, spreading across an area of almost 550 acres.


Panjab University has maintained its streak of Grade 'A' status by NAAC (A-grade) in 2004, 2009 and later in 2014. The University has been recognized by the UGC as the "University with Potential for Excellence in Biomedical Sciences" with facilities for Stem Cell Research and Drug Development. During the 11th Five Year Plan (2007-2012), it was awarded the two Centres of Excellence by the UGC under the Scheme of Centre with Potential for Excellence in a Particular Area (CPEPA). Also, the Department of Science and Technology (DST) has selected Panjab University as one among the 14 top universities of India for funding under the Promotion of University Research and Scientific Excellence (DST-PURSE) Programme from 2015-2020. The university takes pride for being involved in Chandigarh Region Innovation and Knowledge Cluster (CRIKC) Programme.

The University is participating in various prestigious International High Energy Research Programmes at Fermilab (USA), KEK (Japan) and CERN (Switzerland). At present, the University is involved in CMS and ALICE Experiments at CERN (European Organization for Nuclear Research) Switzerland and Neutrino Programme at Fermilab, USA, The University recently signed MoUs with various international universities and institutes such as University of Nottingham (UK), University of Birmingham (UK), Nottingham Trent University (UK) and University of Western Sydney (Australia). PU also has collaborations with National Science Technology and Development Agency, Thailand; University of Missouri, USA and Universidade de Aveiro, Portugal; International Crops Research Institute for Semi-Arid Tropics (ICRISAT), Hyderabad; International Centre for Agricultural Research in Dry Areas (ICARDA).

# DEPARTMENT OF SCIENCE AND TECHNOLOGY

Department of Science & Technology (DST) was established in May 1971, with the objective of promoting new areas of Science & Technology (S&T) and to play the role of a nodal department for organizing, coordinating, and promoting S&T activities in the country. The Department has major responsibilities for specific projects and programmes such as Formulation of policies relating to Science and Technology, Matters relating to the Scientific Advisory Committee of the Cabinet (SACC), Promotion of new areas of Science and Technology with special emphasis on emerging areas, Coordination and integration of areas of Science & Technology having cross-sectoral linkages in which a number of institutions and departments have interest and capabilities, Undertaking or financially sponsoring scientific and technological surveys, research design and development, where necessary and Support and Grants-in-aid to Scientific Research Institutions, Scientific Associations and Bodies.

सत्यमेव जयते
Department of Science and Technology
Ministry of Science and Technology
Government of India

DST has many scientific and engineering programmes that are aimed to promote research in science. It includes creation of Mega Science facilities and launch Mega Science projects in and out of the country to improve access to such state-of-the-art facilities for the Indian scientific community, especially from the academic sector. Because of technical complexities and requirement of large resources, such projects are manifestly multi-agency, multi-institutional and, quite often, international in character. DST and the Department of Atomic Energy (DAE) have been jointly promoting most of such projects in the country. Another innovative program is, Innovation of Science Pursuit for Inspire Research (INSPIRE) for attracting of young talent to science. The R&D Infrastructure Division of the Department aims to strengthen the S&T infrastructure of the country by fostering well-equipped R&D labs in the academic/research institutes/universities as well as a strong culture of research collaboration between institutions and across disciplines. It has four schemes viz. Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST), Promotion of University Research and Scientific Excellence (PURSE), Sophisticated Analytical Instrument Facilities (SAIF), Sophisticated Analytical & Technical Help Institutes (SATHI) and Synergistic Training Program Utilizing the Scientific and Technological Infrastructure (STUTI). The objectives of these program, at large, are establishment of R&D labs, centres, upgradation of research facilities orienting towards creating a self-reliant India.

# SYNERGISTIC TRAINING PROGRAM UTILIZING THE SCIENTIFIC AND TECHNOLOGICAL INFRASTRUCTURE (STUTI)

The program has been designed to cater to human resource and its capacity building through open access to S&T Infrastructure across the country by organizing short term courses/workshops on the awareness, use and application of various instruments and analytical techniques.

# Department of Chemistry


The Department of Chemistry, Panjab University, Chandigarh is one of the oldest and well-established departments in North India. This department is founded by Dr. S.S. Bhatnagar at Lahore in 1925. The department offers B.Sc. and M.Sc. (Honours School), M.Phil. and Ph. D courses with specializations in Physical, organic, Inorganic Chemistry. UGC recognized the department for Special Assistance Program (SAP). Department of Science and Technology accorded it the status of DST-FIST supported department. The department was also acknowledged as the Centre for Advanced Studies (CAS) by UGC. It has also received grant from DST-Fund for improvement of S&T Infrastructure in Universities and Higher Educational Institutions (FIST).

The Department has well-equipped central instrument laboratory with various advanced instruments including IR, UV-vis. spectrophotometer, TGA, DSC, DLS, HPLC and computer laboratories, library which cater to the needs of undergraduate, graduate, and Ph.D. students. Currently more than 100 candidates are pursuing their doctoral studies from this department. The various activities and programs of the department have the potential for developing quality human resource and making job-oriented education.

# SAIF/CIL

Sophisticated Analytical Instrumentation Facility (SAIF)/Central Instrumentation Laboratory (CIL) formerly known as RSIC at Panjab University, Chandigarh was incepted in the earlier years of the 6th plan. The complete facilities of USIC, CIL, SAIF and RSIC are working in unison in the service of research and for imparting practical training to the students through workshops. The Centre also undertakes the design, fabrication and repair of electronic instruments required by students and teachers from the University and the colleges around. It also runs training programmes in technical skills for the benefit of scientific community and associated laboratory staff from different institution.

The Centre houses the following Sophisticated Instruments: Transmission Electron Microscope (TEM) Hitachi (H-7500), Scanning Transmission Electron Microscope (SEM) Model JSM6100 (Jeol) with Image Analyser, Elemental Analyser for CHN (Thermo Scientific), FT-NMR Cryo-magnet Spectrometer 400 MHz (Bruker), X-ray Diffractometer (Powder Method). Panalytical.s X. Pert Pro, LC-MS Spectrometer Model Q-ToF (Micro Waters), Liquid Nitrogen Plant Stirling (StirLIN-1), FTIR Spectrophotometer Model RZX (Perkin Elmer), UV-VISNIR Spectrophotometer Model Lambda 750 (Perkin Elmer), WD-XRF Spectrometer ModelS8 (TIGER Bruker).

# HIGHLIGHTS PROGRAM OF THE TRAINING

X-ray and Chromatographic based methods are used extensively in modern day drug discovery, research and development, and diagnostics. The aim of this 7-day training is to equip participants with the basic knowledge and skills required to handle these sophisticated instruments. This hands-on training program is intended for participants who are seeking basic and advanced-level insight and hands on training on X- ray, Mass spectroscopy, and Chromatography based techniques for chemical science research, supervision, scale-up or manufacturing, other technical operations, or basic/applied research. This includes Faculty/Scientists/Post-Doc Fellows/Ph.D. Fellows/Industry persons who are actively involved in Research and Development (R&D) and require knowledge of X-ray and Chromatographic based methods.

It will enable participants acquire the basic single X-ray techniques required for success in scientific research. Participants will experience hands-on training on, powder XRD, WDXRF, SAXS, HPLC, LC-MS etc. During this training program, attendees will have the opportunity to visit SAIF/CIL and IMTech, which harbour most advanced and sophisticated state-of-the-art instruments. Additionally, the attendees will have an opportunity to closely interact with eminent scientists from this field.

# LEARNING OUTCOMES OF THE PROGRAM

At the end of the training, participants will be conversant with the following:

- Basic and advanced equipment's in X-ray techniques
- Handling of samples during single crystal X-ray studies
- Quantification of data using software
- Technique of powder XRD
- HPLC techniques
- LC-MS technique
- WD-XRF studies
- GC-MS
- Data interpretations of these techniques

# COMMITTEES

Patron

**Prof. Raj Kumar**

STUTI Program Coordinator, Panjab University

**Prof. G.R. Chaudhary**

Chairperson, Dept. of Chemistry

**Prof. Sonal Singhal**

Workshop Convenor

**Dr. Rohit Kumar Sharma**

Organising members

**Dr. Savita Chaudhary** **Dr. Subhash Kumar Sahoo,**

**Dr. Jyoti Aggarwal**

TRAINING PROGRAM

# X-Ray and Chromatographic based Techniques for Academic & Industrial Innovations

**National Mission for Accelerating Growth of New India's Innovation (AGNI)**

(27th May- 3rd June 2022)

Under

Synergistic Training Program Utilizing the Scientific and Technological Infrastructure (STUTI)

Organised by

Department of Chemistry & Centre of Advanced Studies
&
Sophisticated Analytical Instrumentation Facility (SAIF)/
Central Instrumentation Laboratory (CIL), Panjab University, Chandigarh

| **Day-1 (27th May 2022)** | | |
|---|---|---|
| **9.00 am – 10.30 am** | Registration | Venue Seminar Hall SAIF/CIL |
| 10:30 am – 11.30 am | INAUGURATION | Venue Seminar Hall SAIF/CIL |
| 11:30 am -12:00 am | High Tea | SAIF/CIL |
| 12:00 am – 1:30 pm | **Lecture 1:** Introduction About SAIF CIL (Prof. Ganga Ram Chaudhary, Director, SAIF) | Venue Seminar Hall SAIF/CIL |
| 01:30 pm – 02:30 pm | Lunch | |
| 02:30 pm – 06:00 pm | Visit to SAIF/CIL | |
| **Day-2nd (28th May 2022)** | | |
| 09:00 am – 10:30 am | **Lecture 1** – Basics of powder X-ray diffraction, sample preparation, data collection including strategy (Dr. Rajesh Gonade, NCL Pune) | **Venue** Seminar Hall SAIF/CIL |
| 10:30 am – 11:15 am | Interactive Session: Queries, question and trouble shooting | |
| 11:15 am – 12:45 pm | **Lecture 2** – Refinement, data validation and report creation (Dr. Subhash C. Sahoo, Panjab University, Chandigarh) | |

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| 12:45 pm – 01:30 pm | Interactive Session: Queries, question and trouble shooting | |
| 01:30 pm – 02:30 pm | Lunch | |
| 02:30 pm – 05:30 pm | Hands on training on PXRD | |
| 05:30 pm – 06:00 pm | Interactive Session: Queries, question and trouble shooting | |
| **Day- 3 (29th May 2022) Sunday** | | |
| **Day-4 (30th May 2022)** | | |
| 09:00 am – 10:30 am | Lecture 1 – Basics of X-ray diffraction, Crystallographic Symmetry, Point Groups and Space groups (Dr. Angshuman Roy Choudhury, IISER Mohali) | |
| 10:30 am – 11:15 am | Interactive Session: Queries, question and trouble shooting | |
| 11:15 am – 12:45 pm | **Lecture 2** – Basics of Single crystal X-ray diffraction, crystal selection and mounting, data collection including strategy determination. (Prof. P. Venugopalan, Panjab University, Chandigarh) | **Venue** Chemistry Department, PU |
| 12:45 pm – 01:30 pm | Interactive Session: Queries, question and trouble shooting | |
| 01:30 pm – 02:30 pm | Lunch | |
| 02:30 pm – 05:30 pm | Hands on training on Single crystal XRD | |
| 05:30 pm – 06:00 pm | Interactive session - Queries, questions and trouble shooting | |
| **Day 5 (31st May 2022)** | | |
| 09:00 am – 10:30 am | **Lecture 1-** Lecture on Small Angle X-ray Scattering (Dr. Prasad Gosavi, Anton Paar Pvt. Ltd.) | |
| 10:30 am – 11:15 am | Interactive Session: Queries, question and trouble shooting | |
| 11:15 am – 12:45 pm | **Lecture 2** – Lecture on LC-MS and HPLC technique (Prof. Sanjay Jachak, NIPER Mohali) | **Venue** Seminar Hall SAIF/CIL |
| 12:45 pm – 01:30 pm | Interactive Session: Queries, question and trouble shooting | |
| 01:30 pm – 02:30 pm | Lunch | |

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|---|---|---|
| 02:30 pm – 05:30 pm | Hands on training on LCMS | |
| 05:30 pm – 06:00 pm | Interactive session - Queries, questions and & trouble shooting | |
| **Day-6 (1st June 2022)** | | |
| 09:00 am – 10:30 am | **Lecture 1-** General Lecture on Chromatography<br>(Dr. Ramesh, SAIF, Chandigarh) | **Venue**<br>Seminar Hall<br>SAIF/CIL |
| 10:30 am – 11:15 am | Interactive Session: Queries, question and trouble shooting | |
| 11:30 am – 12:45 pm | **Lecture 2** – Lecture on High Performance Liquid Chromatography<br>(From Shimadzu Corporation) | |
| 12:45 pm – 01:30 pm | Interactive Session: Queries, question and trouble shooting | |
| 01:30 pm – 02:30 pm | Lunch | |
| 02:30 pm – 06:00 pm | Hands on training on SAXS | |
| 05:30 pm – 06:00 pm | Interactive session - Queries, questions and trouble shooting | |
| **Day-7 (2nd June 2022)** | | |
| 09:00 am – 10:30 am | **Lecture 1**- Lecture on High Resolution Mass Spectrometry<br>(From Waters Corporation) | **Venue**<br>Seminar Hall<br>SAIF/CIL |
| 10:30 am – 11:15 am | Interactive Session: Queries, question and trouble shooting | |
| 11:15 am – 12:45 pm | **Lecture 2-** Lecture on Matric Assisted Laser Desorption Ionization Technique and its applications<br>(Prof. Gupta Sharma, IISER Mohali) | |
| 12:45 pm – 01:30 pm | Interactive Session: Queries, question and trouble shooting | |
| 01:30 pm – 02:30 pm | Lunch | |
| 02:30 pm – 05:30 pm | Hands on training on HRMS/MALDI | |
| 05:30 pm – 06:00 pm | Interactive session - Queries, questions and & trouble shooting | |
| **Day-8 (3rd June 2022)** | | |
| 09:00 am – 10:30 am | **Lecture 1**- Lecture on Gas Chromatography-Mass Spectrometry<br>(Dr. Shailender Khichi, SAIF, Chandigarh) | **Venue**<br>Seminar Hall<br>SAIF/CIL |

| | |
|---|---|
| 10:30 am – 11:15 am | Interactive Session: Queries, question and trouble shooting |
| 11:15 am – 12:45 pm | **Lecture 2 -** Enantiomeric Separation by GC/HPLC techniques<br>Dr. Jyoti Agarwal (Panjab University, Chandigarh) |
| 12:45 pm – 01:30 pm | Interactive Session: Queries, question and trouble shooting |
| 01:30 pm – 02:30 pm | Lunch |
| 02:30 pm – 03:30 pm | Test and feedback |
| 03:30 pm – 06:00 pm | VALEDICTORY |

# Training Program Highlights
# 27th May to 3rd June 2022

# DAY 1 Inauguration

The 7 days hands-on Training Program on "X-ray and Chromatography based Techniques for Academic & Industrial Innovations" is commenced from 27th May-03rd June 2022 at the Department of Chemistry & Center of Advanced Studies, Panjab University, Chandigarh under STUTI program in association with Sophisticated Analytical Instrumentation Laboratory (SAIF), Panjab University, Chandigarh.

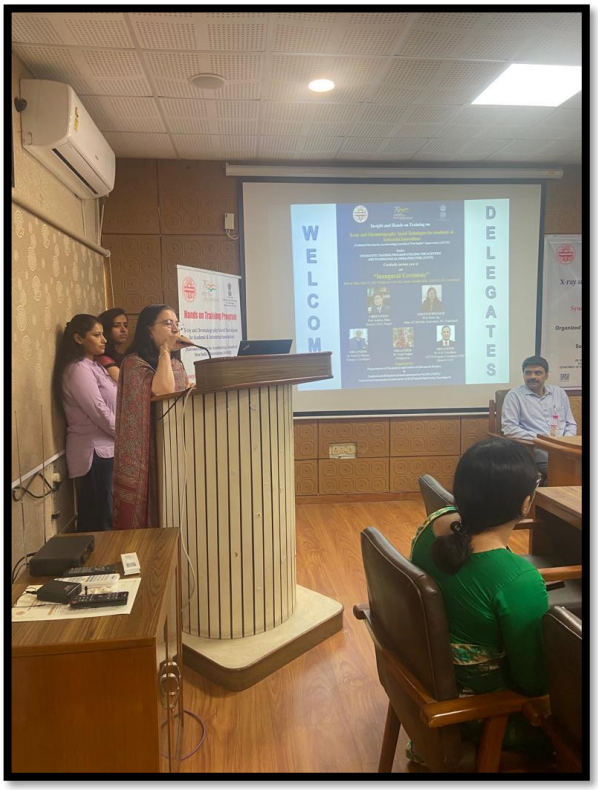
The Scheme 'Synergistic Training program Utilizing the Scientific and Technological Infrastructure' (STUTI) is supported by the Department of Science and Technology, Government of India is intended to build human resources and its knowledge capacity through open access to S&T Infrastructure. It envisions hands-on training and sensitization of the state-of-art instruments in various institutes/departments having availed projects under FIST/PURSE/CURIE/SAIF/ SATHI schemes.

The training program is commenced with the patronship of Honorable Prof. Raj Kumar, Vice-Chancellor, PU, Chandigarh and inaugurated by Worthy Chief Guest Prof. Amitava Patra, Director, INST, Mohali, Punjab and Guest Of Honour Prof. Renu Vig, Dean of University Instruction, PU, Chandigarh. is

Prof. Sonal Singhal, chairperson, Department of Chemistry gives cordial welcome to the Chief Guest, Guest of Honour and all the participants of the program. Dr. Rohit Kumar, coordinator, training program highlights the key points of the STUTI training program, its schedule and emphasizes on the importance of the training program.

Prof. Ganga Ram Chaudhary is the Coordinator of the STUTI Program-PMU & Director, SAIF, PU, Chandigarh emphasized on the goals and visions of the STUTI scheme to the participants. 30 participants from 23 different institutes/universities have been participating in this training program representing 8 States/UTs. The Training Manual of the training program is unveiled by the honorable Chief Guest and other dignitaries in the presence of all the participants.

Prof. Renu Vig welcomed the participants and highly appreciates the efforts of the organizing committee members of the training program for the commencement of such a wonderful event. Prof. Amitava Patra addressed the participants and highlights the importance of Hands-on training in enhancing the technical skills. Prof. Savita Chaudhary presents the vote of thanks to the dignitaries and wishes good luck to all the participants for the training program.


Many eminent resource persons are invited for delivering lectures during the 7 days training program to impart participants with the basic knowledge and skills. Participants will be imparted hands-on training on several instruments such as FESEM, NMR, XRD, FTIR, LC-MS etc.

Department of Chemistry and SAIF, PU, Chandigarh appreciates the efforts and commitments shown by the organizing committee members, technical staff and research scholars for the successful execution of STUTI supported training program. The event is further graced by the presence of Dr. Subhash C Sahoo and Dr. Jyoti Aggarwal, Department of Chemistry, PU, Chandigarh organizing member of STUTI training program.


Hands on Training Program


SAIF, CIL, UCIM, USIC

# Hands-on Training

# DAY 2

Speaker from NCL, Pune, Dr. Rajesh Gonade delivered a talk on powder X-Ray Diffraction, sample preparation and analysis. A deliberate talk on basic crystal structures were given to the participants followed by critical analysis using diffraction technique. 30 participants from all over the India representing 23 institute and 8 states/ UTs from research background are participating in this STUTI training program. the research background representing 19 different states and 30 institutes are participating in this STUTI training program. Dr. Subhash C Sahoo delivered a lecture on refinement, data validation and report creation in PXRD.

During the second half, hands-on training was imparted to the participants on XRD. Different types of samples were analyzed by the participants during the training. The training session was followed by the queries, doubts, discussions, and trouble shootings. An interactive session takes place amongst the participants and experts during the hands-on training.


Particle size determination: Example
Peak at 28.2° 2θ with FWHM of 0.36° 2θ
Standard material has FWHM of 0.16° 2θ
λ = CuKα = 1.540 Å
B_M = 0.36 ° = 0.36 x π/180 = 0.0063 rad
B_S = 0.16 ° = 0.16 x π/180 = 0.0028 rad
B = 0.0056 rad
B² = B_M² − B_S²
14.1°
19nm

Hands on training

# DAY 3

Prof. Venugopalan delivered a lecture on Structure elucidation through X-Ray Crystallography: Significance and methods."

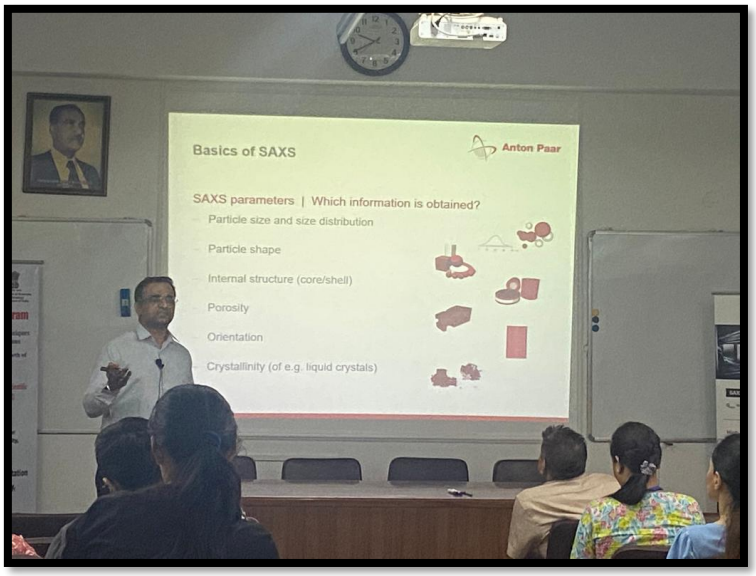
Dr. Angshuman Roy from IISER, Mohali emphasized the talk on symmetry and point group, crystal selection, mounting, data collection and data validations in XRD.

During second half, an interactive hands-on training on SCXRD was given to the participants. The samples of the participants were also analyzed during the training program. Participants were happy and satisfied with the results of the analysis.

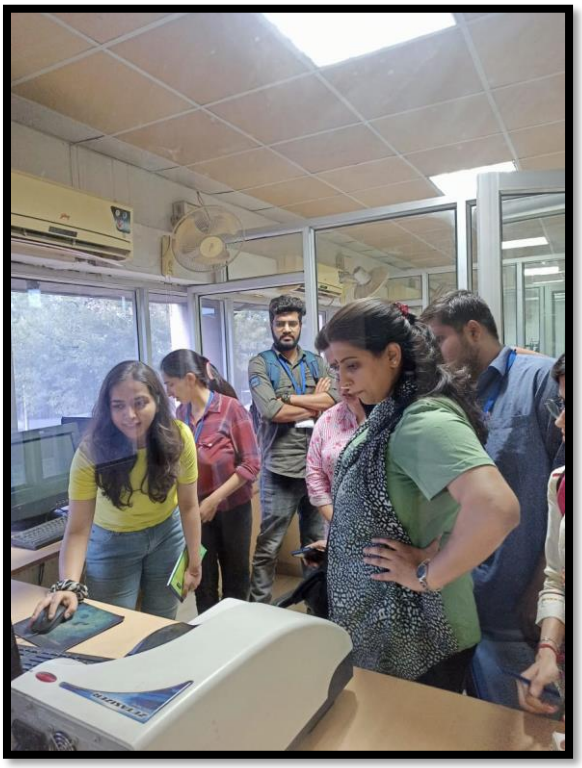
Hands on Training

# DAY 4

Dr. Prasad Gosavi, Anton Paar Pvt. Ltd delivered a Lecture on Small Angle X-ray Scattering. Participants were made aware how it measures the intensities of X-rays scattered by a sample as a function of the scattering angle. Prof. Sanjay Jachak, NIPER Mohali) delivered a lecture on LC-MS and HPLC technique.




Speakers interacted with the participants and talk about mass spectrometry techniques, applications, and future advancement. Practical analysis is performed using sophisticated instruments during the hands-on session.



# DAY 5

Expert talk on Chromatography by Dr. Ramesh Kumar, SAIF, PU Chandigarh and talk on High performance Liquid Chromatography was delivered by From Shimadzu Corporation, respectively. An interactive session was occurred during the lectures. During the second half, the hands-on training was imparted to the participants on SAXS followed by doubts and queries.


Hands on training on SAXS

# DAY 6

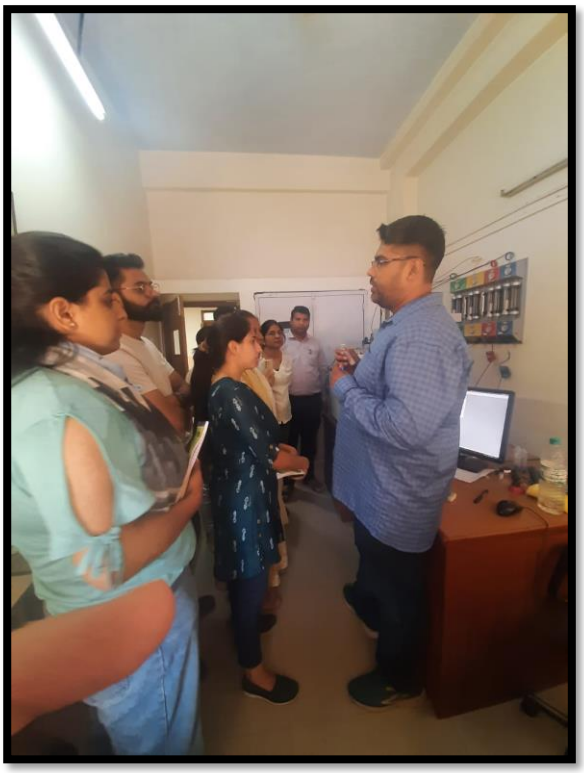
Expert talk on concepts of HRMS and its instrumentation was given to the trainee by Mr. Sarthak Gupta, Product Executive for Mass spectrometry, Waters India Pvt Ltd. Prof. Gupta Sarma, IISER Mohali emphasized on "Insights into MALDI: Basic Concepts, Applications, and Instrumentation. An interactive lecture occurred followed by queries.

During the second half, the hands-on training on MALDI were imparted to the participants by Mr. Anoop. Participants felt motivated and appreciated the DST,

Government of India for creating a platform where researchers can enhance their technical skills. They are thankful to all the technical staff, organizing members and volunteers involved in hands-on training at Department of Chemistry & SAIF/CIL, PU Chandigarh.

# DAY 7

Expert lecture on Gas chromatography mass spectrometry (GC-MS) was delivered by Dr. Shailendra Singh. Participants were imparted with the working principle and applications of the technique. The talks were followed by the hands-on training on the GC-MS.

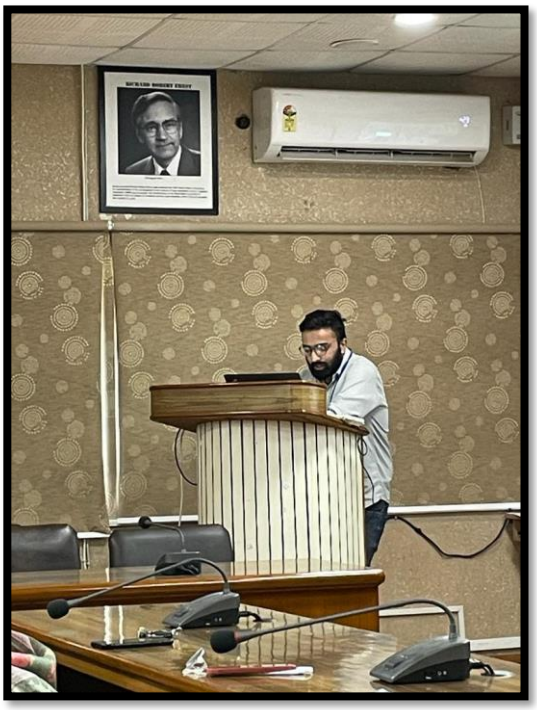



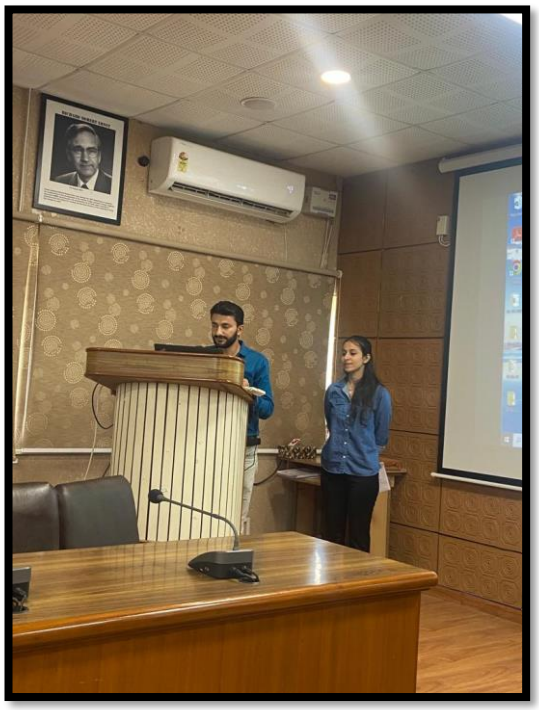
During the second half, the valedictory session of the training program was commenced in the presence of honorable Chief Guest Prof. Yajvender Pal Verma, Registrar, PU, Chandigarh; Prof. Ganga Ram Chaudhary, STUTI Program coordinator (PMU), PU, Chandigarh, Prof. Sonal Singhal, Chairperson, Department of chemistry, PU, Chandigarh and Dr. Rohit Kumar Sharma, Training coordinator, Department of chemistry, PU, Chandigarh.

Prof. Y.P. Verma addressed the participants and appreciated the efforts of all the coordinators for successfully organizing & completing the STUTI training program. The welcome note from all other dignitaries followed by the event summary and felicitation were the key highlights of the valediction. The feedback of the participants was received at the end.

Participants were happy with the hands-on training provided during the training program and free of cost sample analysis. They felt motivated and highly appreciated the initiative taken by the DST, Govt. Of India for creating a platform where all

researchers can enhance their technical skill through open access to S&T infrastructure. They were grateful to the dignitaries, program coordinators, organizers, support staff, technical support, and everyone for the successful commencement of the STUTI training program. Participants presented cultural activities of their own states after the valediction.

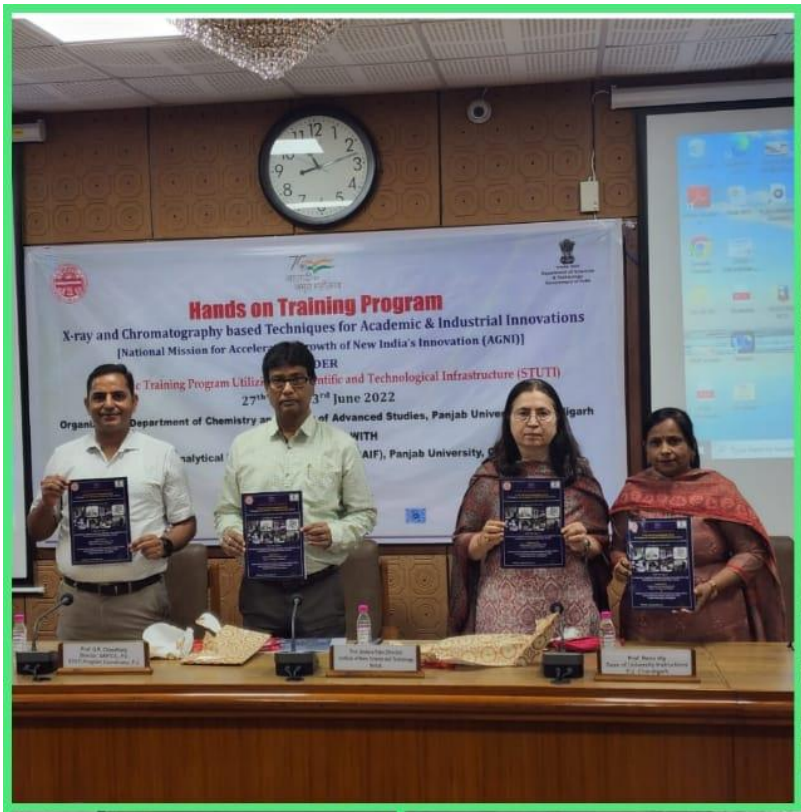




PARTICIPANTS FEEDBACK

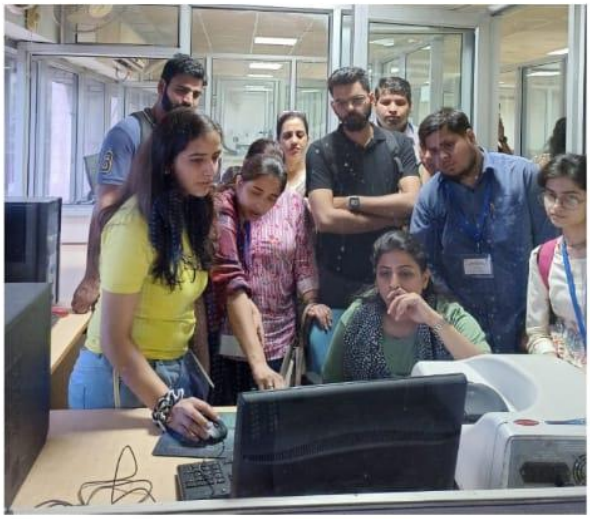
# GALLERY

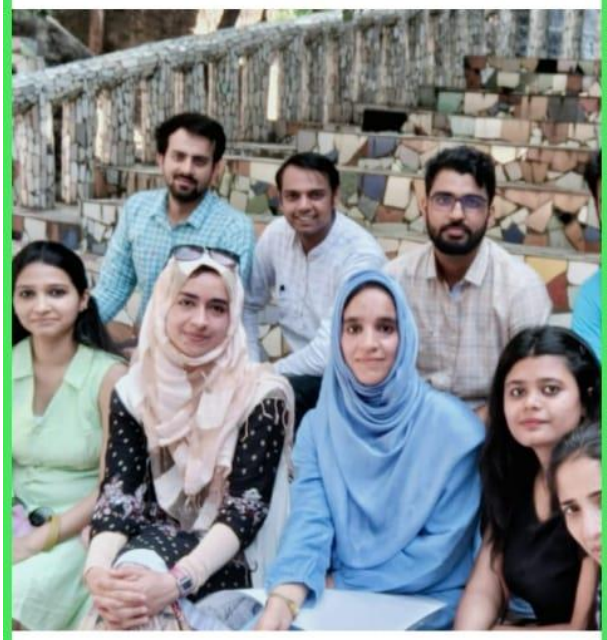

1: Inaugration (27th May

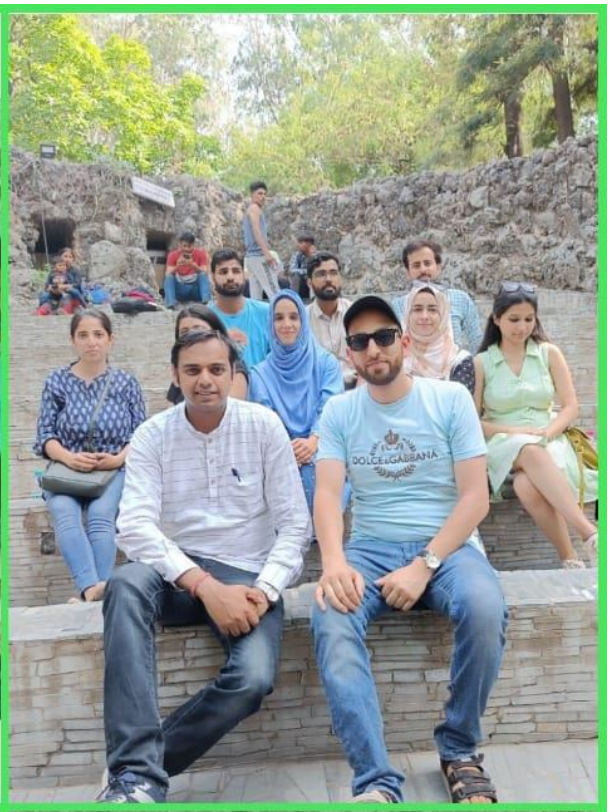

Hands on Training Program
X-ray and Chromatography based Techniques for Academic & Industrial Innovations

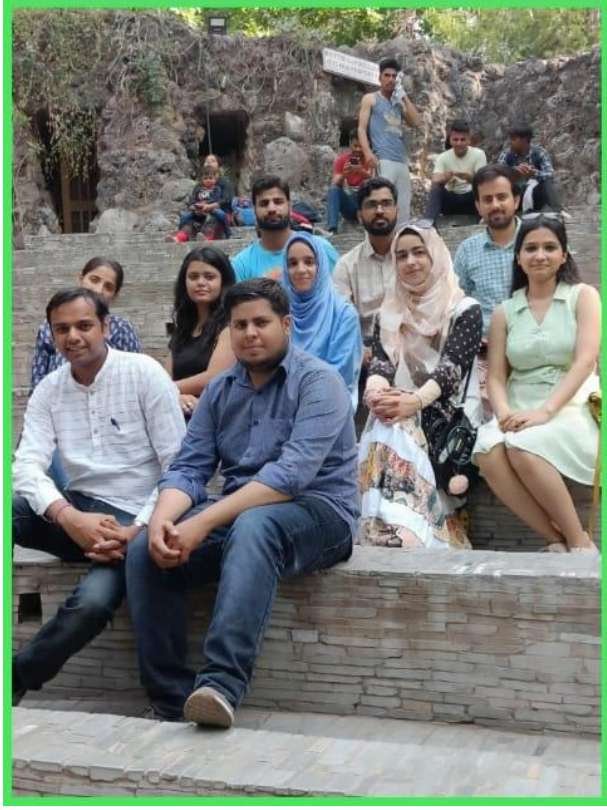

Conformation
Cyclohexane
Chair
Boat


Microscope






DOLCE&GABBANA




BROOKLYN


BROOKLYN
88

# List of Participant

| S. No. | Name | Position | Institute/University |
|---|---|---|---|
| 1 | **Sonali Mehra** | DST-WOMEN SCIENTIST A | CSIR-NPL Delhi |
| 2 | **Ishani Saini** | Research Scholar | Central University of HP, Shahpur |
| 3 | **Shubham Mahajan** | R&D Department | HPU, Shimla<br>Natural Biotech Products |
| 4 | **Pooja Rani** | Research Scholar | CCSHAU, Hisar |
| 5 | **Vineeta Rana** | Research Scholar | CCSHAU, Hisar |
| 6 | **Pooja Rani** | Research Scholar | GJU, Hisar |
| 7 | **Swapna Pahra** | Project Associate-I | CSIR-CSIO, Chandigarh |
| 8 | **Gousia** | Research Scholar | University of Kashmir |
| 9 | **Firdaus Ahmad** | Research Scholar | University of Kashmir |
| 10 | **Saima Sidiq** | Research Scholar | University of Kashmir |
| 11 | **Ishtiyaq Ahmad** | Research Scholar | University of Kashmir |
| 12 | **Dr Adil Shafi Ganie** | Researcher | Aligarh Muslim University |
| 13 | **Sweta Sharma** | Research Scholar | CSIR-CSIO,Chandigarh |
| 14 | **Kunal Madaan** | Research Scholar | Delhi Technological University |
| 15 | **Ms Anshika Baghla** | Research Scholar | IISER Mohali |
| 16 | **Naresh Kumar** | Assistant Professor | MLSM College, Sundarnagar Mandi |
| 17 | **Dr. Vandana Sharma** | Assistant Professor | MLSM College, Sundarnagar Mandi |
| 18 | **Priyanka Chauhan** | Assistant Professor | MLSM College, Sundarnagar Mandi |
| 19 | **Chetan Chauhan** | Research Scholar | HPU, Shimla |
| 20 | **Akanksha Singh** | Research Scholar | University of Allahabad |
| 21 | **Sukanya Bhoumik** | Research Scholar | University of Allahabad |
| 22 | **Neha Bharti** | Research Scholar | University of Rajasthan, Jaipur |
| 23 | **Dr Bhupender Singh** | Principal Technical Officer | Central Research Facility, IIT Delhi |
| 24 | **Shelly** | Research Scholar | Panjab Agriculture University, Ludhiana |

| | | | |
|---|---|---|---|
| 25 | **Madhu Rav** | Research Trainee | Kurukshetra University |
| 26 | **Dr Pinky Satija** | Assistant Professor | Shoolini University |
| 27 | **Veena Devi** | Research Scholar | Department of Biotechnology, Panjab University |
| 28 | **Rohit Bansal** | Research Scholar | Department of Biochemistry, Panjab University |
| 29 | **Dr. Maitrayee Trivedi** | Research Associate | Department of Chemistry, Panjab University |
| 30 | **Deepak Kumar** | Research Scholar | Department of Physics, Panjab University |
| 31 | **Diksha Kumari** | Research Scholar | PEC, Chandigarh |
| 32 | **Priyanshi Agnihotri** | Research Scholar | Department of Chemistry, Panjab University |
| 33 | **Tamanna Wadhawan** | Research Scholar | GGDSD College Chandigarh |
| 34 | **Deepika Sharma** | Research Scholar | Panjab University |
| 35 | **Surekha Devi** | Research Scholar | Panjab University |
| 36 | **Surbhi** | Research Scholar | PEC, Chandigarh |
| 37 | **Dr. Himanshu Gupta** | Head, Department of Chemistry | IFTM University, Moradabad |
| 38 | **Pooja Sharma** | Research Scholar | CCSHAU, Hisar |

# STAFF LIST OF CIL/SAIF/UCIM OF PANJAB UNIVERSITY, CHANDIGARH

## DIRECTOR /FACULTY MEMBERS :-

| Sr. No. | Name of Employee | Intercom No. | Resi. (Ph.) / Mobile No. |
|---|---|---|---|
| 1. | Prof. G.R. Chaudhary | 4047 | 9878822323 |
| 2. | Er. H.P.S. Kang | 4055 | 2664442 |
| 3. | Er. Poonam Kumari | 4051 | 2540580/9872663277 |
| 4. | Dr. Ramesh K Sharma | 4058 | 9815604963 |
| 5. | Dr. Anil Kumar | 4050 | 2721666/9876191493 |

## LAB INCHARGE/ INSTRUMENTATION FACILITY

| Sr. No. | Name of Employee | Lab | Intercom No. | Resi. (Ph.) / Mobile No. |
|---|---|---|---|---|
| 1. | Mr. Dinesh Sharma | HR-TEM/ Mechanical WS | 4082 | 9815602568 |
| 2. | Dr. Rajender Singh | HR-TEM/FESEM/ Ultramicrotome/ CPD | 4057 | 9501239960 |
| 3. | Mr. Jagtar Singh | | 4081 | 2626420/9888368019 |
| 4. | Mr. Subash Chand | XRD/SAXS | 4081 | 8872081092 |
| 5. | Mr. Manish | UV-VIS/ FTIR | 500MHz | 9781012525 |
| 6. | Mrs. Geeta Arora | NMR | 4050 | 2565407/9872981211 |
| 7. | Mr. Dharamvir | GCMS | 4082 | 9779303149 |
| 8. | Ms. Ramneek Kaur | Wood Workshop | | 8146665583 |
| 9. | Mr Harkamal Singh | LCMS | | 9417774268 |
| 10. | Anit Kumar | UV-VIS/ FTIR | | 9041907917 |
| 11. | Maninder Kumar | CHNSO/Rheometer | | 9041301064 |
| 12. | Kuldeep | NMR | | 9467618184 |
| 13. | Sushil Kumar Shukla | ICPMS/XRF/AAS | | 9888604727 |
| 14. | Rakesh Kumar | Elect. WS/ Mech. WS/ Glass Blowing Wood Workshop / LN2/AC Plant & Service/ Seminar Hall & Committee Room | | 9888322808 |
| 15. | Mr. Anoop Patyal | LCMS/ Maldi-TOF Synapt XS HDMS/Confocal M | 4058 | 9888397680 |
| 16. | Mr. Sarabjit Singh | LN2/RFDC/ Elec. WS/ Mech WS/ AC Plant & Service/ Seminar Hall & Committee Room | 4083 | 9914618880 |
| 17. | Mr. Neeraj Jaswal | CHNSO/Rheometer /ICPMS/ XRF/AAS | 4080 | 7696585934 |

| | | | | |
|---|---|---|---|---|
| 18. | Mr. M.B. Anitha | FESEM / SEM | 4048 | 9063153147 |
| 19. | Mr. Navjot Singh | RFDC/GB/LN2/AC P& S/ SH & CR | | 7986760188 |
| 20. | Dr. Deepika Jamwal | HR-TEM | | 9418138882 |
| 21. | Mr. Arun Sharma | Store | | 9872547156 |
| 22. | Dr. Navneet Kaur | SAXS/XRD/ICPMS | | 9646036006 |
| 23. | Dr. Preeti Garg | SAXS/XRD/ Confocal M | | 8929748680 |
| 24. | Mr. Balbir Singh | Electrical | | 9872996186 |

# CHARGES OF ANALYSIS

## 400MHZ FT-NMR SPECTROMETER

| Facilities | | P.U |
|---|---|---|
| 1 D (1H NMR,13C NMR, DEPT Experiment, NMR of any other Nucleus) (for each sample) | CDCL3/ D2O | 200 |
| | DMSO-d6 | 400 |
| 2D (2DCOSY, NOESY, Experiments, HSQC, ROESY, TOCSY, HMBC Experiment, Any other 2D experiment) (for each sample) | CDCL3 / D2O | 400 |
| | DMSO-d6 | 600 |

## 500MHZ FT-NMR SPECTROMETER

| P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|
| 320 | 400+18% GST | 1200+18% GST | 2000+18% GST |
| 520 | 600+18% GST | 1400+18% GST | 2200+18% GST |
| 640 | 800+18% GST | 2400+18% GST | 4000+18% GST |
| 840 | 1000+18% GST | 2600+18% GST | 4200+18% GST |

## MALDI-TOF SYNAPT XS HD MASS SPECTROMETER

| Facilities | P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|---|
| Protein intact Mass by UPLC MS | 900 | 1200 +18% GST | 3600 +18% GST | 6000 +18% GST |
| **MALDI TOF/TOF-** Protein identification by MS/MS for gel band and gel spots | 750 | 1000 +18% GST | 3000 +18% GST | 5000 +18% GST |
| Protein Profiling for complex mixture using 2D Nano-LC. (LC/MS/MS) | 1350 | 1800 +18% GST | 5400 +18% GST | 9000 +18% GST |
| Sequencing of Peptides using Bio Lynx software (for pure peptide only) (direct infusion) | 750 | 1000 +18% GST | 3000 +18% GST | 5000 +18% GST |
| Molecular weight confirmation/accurate mass determination. | 750 | 1000 +18% GST | 3000 +18% GST | 5000 +18% GST |
| Polymer analysis etc. | 750 | 1000 +18% GST | 3000 +18% GST | 5000 +18% GST |
| Ion Mobility Study to separate reverse peptide or isobaric compounds using Drift scope Software | 450 | 600 +18% GST | 1800 +18% GST | 3800 +18% GST |
| ETD compounds study. | 750 | 1000 +18% GST | 3000 +18% GST | 5000 +18% GST |

## LIQUID CHROMATOGRAPHY MASS SPECTROMETRY

| Facilities | P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|---|
| MASS | 480 | 600+18% GST | 1800+18% GST | 3000+18% GST |
| LCMS | 800 | 1000+18% GST | 3000+18% GST | 5000+18% GST |
| MS-MS | 640 | 800+18% GST | 2400+18% GST | 4000+18% GST |
| HRMS | 800 | 1000+18% GST | 3000+18% GST | 5000+18% GST |

## WAVELENGTH DISPERSIVE X-RAY FLUORESCENCE

| Facilities | P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|---|
| Powder/ Solid Samples | 480/- | 600/-+18% GST | 1800/- +18% GST | 3000/- +18% GST |
| Liquid Samples (Charges as per Element) | 320 | 400+18% GST | 1200+18% GST | 2000+18% GST |

## FIELD EMISSION SCANNING ELECTRON MICROSCOPE

| Facilities | P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|---|
| FESEM | 960 | 1200+18% GST | 3600+18% GST | 6000+18% GST |
| EDX | 240 | 300+18% GST | 900+18% GST | 1500+18% GST |
| Mapping | 240 | 300+18% GST | 900+18% GST | 1500+18% GST |

## GAS CHROMATOGRAPHY MASS SPECTROMETRY

| Facilities | P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|---|
| GCMS | 800 | 1000+18% GST | 3000+18% GST | 5000+18% GST |
| MS only / GC only | 480 | 600+18% GST | 1800+18% GST | 3000+18% GST |

## CHNS-O ELEMENTAL ANALYZER

| Facilities | P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|---|
| CHNS | 640 | 800+18% GST | 2400+18% GST | 4000+18% GST |
| CHNS-O | 1280 | 1600+18% GST | 4800+18% GST | 8000+18% GST |

## INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY (ICP-MS)

| Facilities | P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|---|
| Standardization | 300 | 600 + 18% GST | 1800 + 18% GST | 3000 + 18% GST |
| Subsequent sample per element | 75 | 100 + 18% GST | 300 + 18% GST | 500 + 18% GST |
| Sample Digestion | 400 | 500 + 18% GST | 1500 + 18% GST | 2500 + 18% GST |

## LIQUID NITROGEN

| P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|
| 30 | 40+18% GST | 50+18% GST | 100+18% GST |

## FT-IR SPECTROPHOTOMETER

| P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|
| 160 | 200+18% GST | 600+18% GST | 1000+18% GST |

## SMALL ANGLE X-RAY SCATTERING

| P.U | Other Educational Inst. | R&D | Industry |
|---|---|---|---|
| 500 | 1000+18% GST | 3000+18% GST | 5000+18% GST |

## MICROPHOTOGRAPHY

| P.U | Other Edu. Inst. | R&D | Industry |
|---|---|---|---|
| 15/shot | 20/shot+18% GST | 40/shot+18% GST | 100/shot+18% GST |

## UV-VIS-NIR

| P.U | Other Edu. Inst. | R&D | Industry |
|---|---|---|---|
| 70 | 90+18% GST | 270+18% GST | 450+18% GST |

## REOMETER

| P.U | Other Edu. Inst. | R&D | Industry |
|---|---|---|---|
| 50 | 60+18% GST | 180+18% GST | 300+18% GST |

## TRANSMISSION ELECTRON MICROSCOPE

| P.U | Other Edu. Inst. | R&D | Industry |
|---|---|---|---|
| 800 | 1000+18% GST | 3000+18% GST | 5000+18% GST |

## X-RAY DIFFRACTROMETER

| P.U | Other Edu. Inst. | R&D | Industry |
|---|---|---|---|
| 320 | 400+18% GST | 1200+18% GST | 2000+18% GST |

## SCANNING ELECTRON MICROSCOPE

| P.U | Other Edu. Inst. | R&D | Industry |
|---|---|---|---|
| 560 | 700+18% GST | 2100+18% | GST 3500+18% GST |

## LAB VISIT, SEMINAR HALL & WORKSHOP CHARGES

| Lab Visit Charges | Workshop Charges | Seminar Hall Booking - 3500/- |
|---|---|---|
| 750 + 18% GST | As per job requirement | for PU & 3500 + 18% GST |

# SOPHISTICATED ANALYTICAL INSTRUMENTATION FACILITY
# &
# CENTRAL INSTRUMENTATION FACILITY
# PANJAB UNIVERSITY, CHANDIGARH - 160014 (INDIA)


MALDI TOF SYNAPT XS HD MASS SPECTROMETER


LC-MS


GC-MS


FT-NMR 400 MHZ


FT-NMR 500 MHZ


TEM


HR-TEM


ULTRA MICROTOME


FE-SEM


SEM


CONFOCAL MICROSCOPE


MICROPHOTOGRAPHY


XRD


XRF


SAXS


ICP-MS


CHNS-O


UV-VIS-NIR / FTIR


TGA/DSC


SPECTROSCOPIC ELLIPSOMETER


POLARIMETER


BET ANALYSER


ZETA SIZER


LIQUID NITROGEN

- We invite young and experienced researchers, R&D Labs, MSME and Industries to make use of the instrumentation facilities available with SAIF/CIL, Panjab University, Chandigarh.
- Sample submission for SAIF/CIL Instruments will be accepted only through Online request form available at webpage https://onlinesaif.puchd.ac.in
- Tel.: +91 172 2534046 | E-mail: rsic@pu.ac.in | www.onlinesaif.puchd.ac.in