Sophisticated Analytical Instrumentation Facility (SAIF-SPIHER)

St. Peter's Institute of Higher Education and Research

Avadi, Chennai – 600 054.

Instrumentation Facilities, Research Outcomes and Events of SAIF-SPIHER

Sophisticated Analytical Instrumentation Facility of St. Peter's Institute of Higher Education and Research **(SAIF-SPIHER)** stands tall today as a central sophisticated instrumentation facility of St. Peter's Institute of Higher Education and Research, since its establishment in the year 2014. SAIF-SPIHER facilitates the researchers of all and the sundry associated with research by providing guidance in acquisition of data using the advanced reflectance and the transmittance spectroscopic techniques viz., **FTIR-ATR**, **UV-Vis DRS/DTS** and **Photo Luminescence** spectral measurements. Till date, SAIF-SPIHER has analyzed more than 6000 samples. SAIF-SPIHER also extends its consultancy services to Industries, R&D laboratories and educational institutions. SAIF-SPIHER organizes workshops in regular manner on the working principle and application of the available spectroscopic techniques at SAIF-SPIHER for students, teachers and personnel from other Laboratories, Universities and Industries. SAIF-SPIHER has recently extended its service to educate the young minds with the sophisticated instrumentations involved in research by organizing Summer Internship Programme for I year PG Students who are pursuing physical and chemical sciences. SAIF-SPIHER provides facilities of sophisticated instruments to scientists and other users from academic institutes, R&D laboratories and industries to enable them to carry out measurements for R&D work. SAIF-SPIHER offers instrumentation facilities to scientists at affordable charges to unveil new dimensions of research in various areas of science and technology.

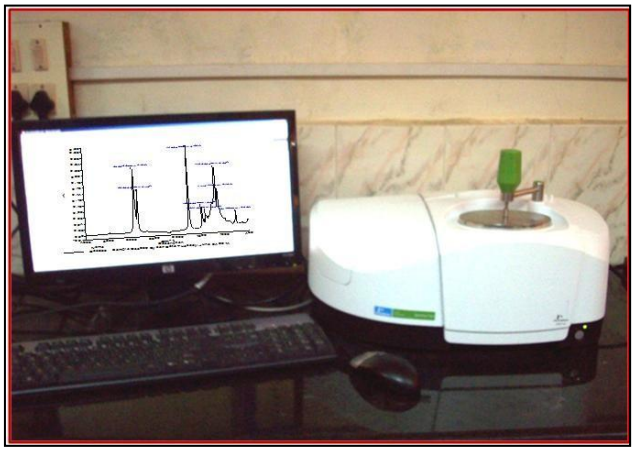
Instrumentation Facilities at SAIF-SPIHER

(i) PERKIN ELMER - SPECTRUM TWO FTIR/ATR SPECTROMETER

Mid-Infrared (IR) spectroscopy is an extremely reliable and well recognized fingerprinting method. Many substances can be characterized, identified and also quantified. One of the strengths of IR spectroscopy is its ability as an analytical technique to obtain spectra from a very wide range of solids, liquids and gases. However, in many cases some form of sample preparation is required in order to obtain a good quality spectrum. Traditionally IR spectrometers have been used to analyze solids, liquids and gases by means of transmitting the infrared radiation directly through the sample. Where the sample is in a liquid or solid form the intensity of the spectral features is determined by the thickness of the sample and typically this sample thickness cannot be more than a few tens of microns. The technique of Attenuated Total Reflectance (ATR) has in recent years revolutionized solid and liquid sample analyses because it combats the most challenging aspects of infrared analyses, namely sample preparation and spectral reproducibility.

Description

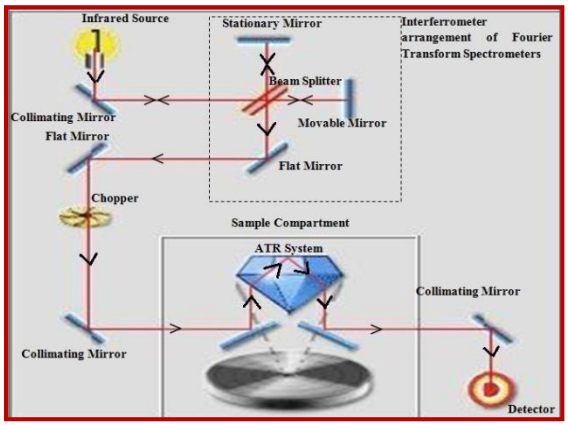
The interference pattern obtained from a two beam interferometer as the path difference between the two beams is altered, when Fourier transformed, gives rise to the spectrum. The transformation of the interferogram into spectrum is carried out mathematically with a dedicated on-line computer.



PerkinElmer Spectrum Two FTIR-ATR Spectrophotometer

The Perkin Elmer Spectrum Two FTIR instrument consists of globar and mercury vapor lamp as sources, an interferometer chamber comprising of KBr and mylar beam splitters followed by a sample chamber and detector. Entire region of 4000 – 400 cm^{-1} is covered by this instrument. The spectrometer works under purged conditions. Solid samples are dispersed in KBr or polyethylene pellets depending on the region of interest. This instrument has a typical resolution of 0.5 cm^{-1}. Signal averaging, signal enhancement, base line correction, normalization and other spectral manipulations are possible.

The FTIR Spectroscopy is carried out by using ATR Diamond Accessory. Reflection which occurs when, an absorbing coupling mechanism acts in the process of Total Internal Reflection to make the Reflectance less than unity. In this process, if the absorbing sample is placed in contact with the reflecting surface, the reflectance for total internal reflection will be attenuated to some value between greater than zero and unity in regions of the spectrum, where absorption of the radiant power can take place. The technique of Attenuated Total Reflectance (ATR) has in recent years revolutionized solid and liquid sample analyses because it combats the most challenging aspects of infrared analyses, namely sample preparation and spectral reproducibility. In no time the spectrum software provides, derivative (up to fourth derivative) and mathematically modified spectra of the samples.



Optical Path Schematic of FTIR-ATR Spectrophotometer

Instrument Details

Model	**Spectrum Two FTIR/ATR Spectrometer**
Scan Range	**MIR 4000 - 400cm^{-1}**
Resolution	**0.5 cm^{-1} onwards**
Internal Reflection Element (IRE)	**Diamond**
Refractive Index	**2.4**
Sample required	**1-2 mg (Solid)/ 1-2 ml (liquid other than water)**
Mode of Analysis	**Absorbance/ Transmittance**

Applications

Infrared spectrum is useful in identifying the functional groups like -OH, -CN, -CO, -CH, -NH2, etc. Also quantitative estimation is possible in certain cases for chemicals, pharmaceuticals, petroleum products, etc. Resins from industries and rubber samples can be analyzed (based on the refractive index of the samples). Blood and food materials can also be studied.

(ii) PERKIN ELMER LAMBDA 35 UV Vis DRS/DTS Spectrometer

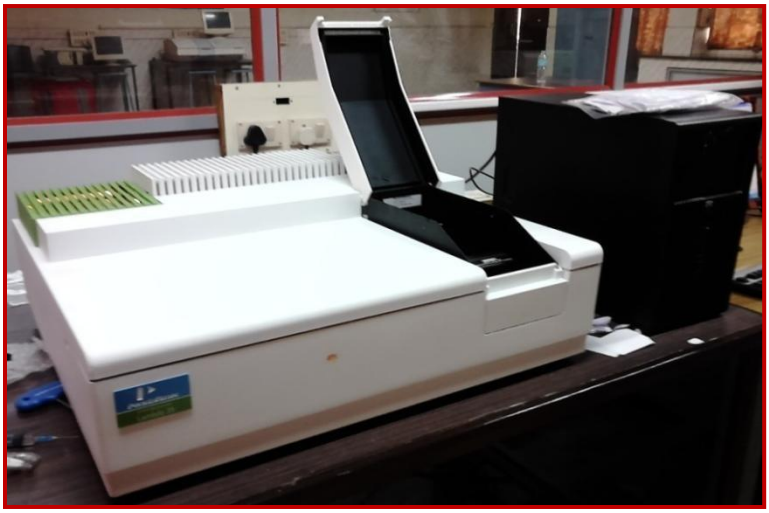
The UV-VIS spectrum is due to the electronic transitions of the molecule. Qualitative and quantitative estimations of compounds are possible by this non destructive technique.

Description

The Absorbance (A) of a solution at a particular wavelength is given by Beer-Lambert's law ect = A where c is the concentration of the compound, t is the thickness of the cell and e is the molar extinction coefficient characteristic of the compound at a given wavelength. This principle is used for quantitative measurements.

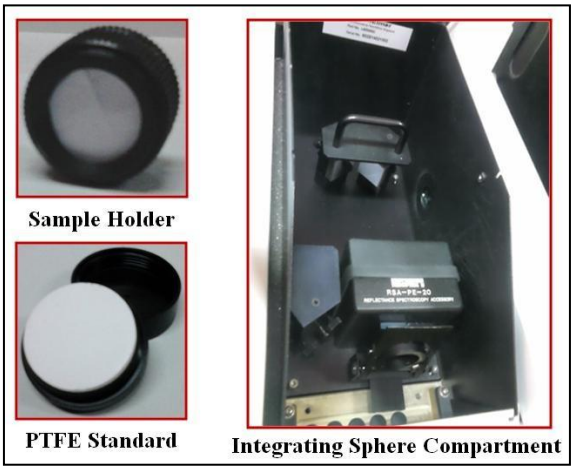
When electromagnetic radiation in the UV/Visible wavelength range interacts with a sample, four results are possible: the radiation is absorbed, transmitted, reflected or scattered. Typically UV/Vis spectrometers are equipped to measure the transmittance or absorbance of a transparent solid or homogenous solution. However, when equipped with the proper accessories, UV/Vis instruments can measure the reflected and scattered energy from a sample. An integrating sphere, when used in combination with the UV-Visible spectrometer, is a

valuable tool for collecting and measuring specular and/or diffuse reflectance. By placing the sample at the entrance to the sphere, transmitted light enters the sphere and is collected and measured at the detector in diffuse transmittance mode. Alternatively, by placing a sample at the exit of the sphere, reflected light is collected and measured at the detector in diffuse reflectance mode. The reflectance spectrum may be converted to Kubelka-Munk spectrum for further studies.

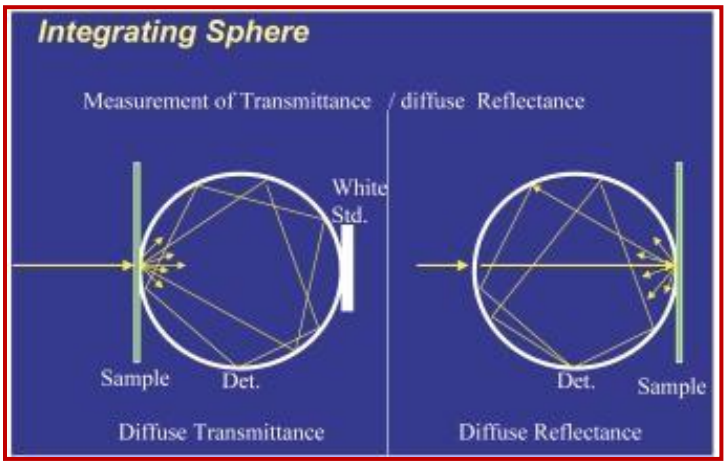


PerkinElmer Lambda 35 UV-Vis DRS/DTS Spectrometer

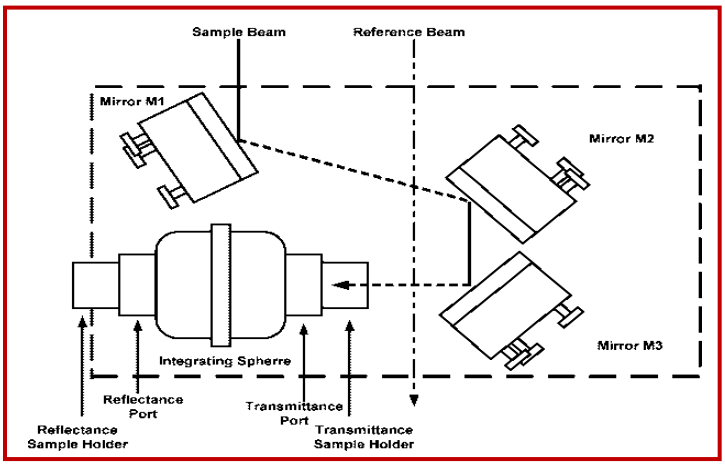
The spectrometer is well suited for samples both in solid and the dissolved (solution) form. The spectral range with appropriate solvent is 190-1100 nm and also it can be used to study single crystals and powder samples. Base line correction, Normalization, repetitive scan, kinetics, derivative and concentration modes are possible.



DRS/DTS Setup of Lambda 35 UV-Vis



Measurement Principles of the Integrating Sphere



Optical Path Schematics of UV-Vis DRS/DTS Spectrophotometer

Instrument Details

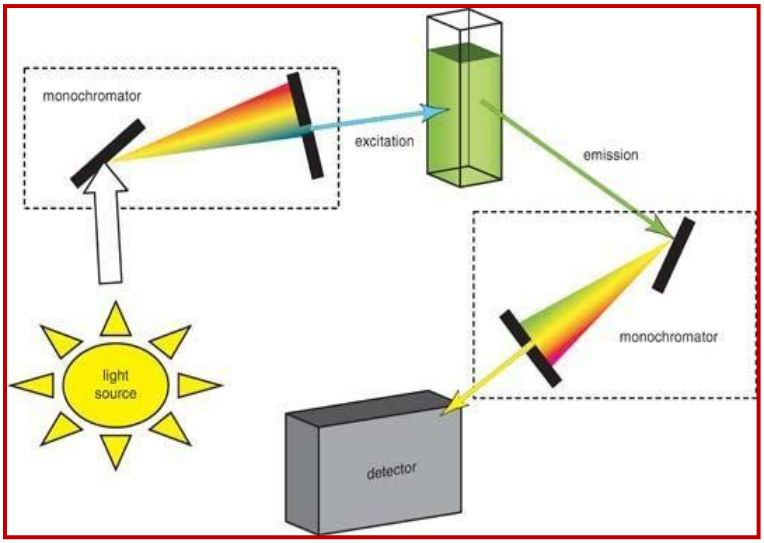
Model	**Lambda 35 UV - Vis DRS/DTS Spectrometer**
Scan Range	**190 – 1100 nm**
Bandwidth	**0.5 – 4 nm (variable)**
Mode of Analysis	**Transmittance/ Absorbance/ Reflectance**
Sample required	**5-10 mg (DRS) & 1-2 mg with Solvent (%T)**

Applications

Qualitative and quantitative studies of materials and study of molecular structure, reaction kinetics, defect solid state, color centres, etc. The variable bandwidth of the LAMBDA 35 offers the best solution for measurements on solids, pastes and powders.

(iii) PERKIN ELMER – LS 45 LUMINESCENCE SPECTROMETER

The LS 45 is a computer controlled, modular Photoluminescence spectrometer for measuring steady state luminescence spectra in the ultraviolet to near infrared spectral range with single photon counting sensitivity. It combines ultimate sensitivity with high spectral resolution and excellent stray light rejection. The performance of the PL spectrometer makes it ideally suited for demanding applications in the broad areas of photophysics, photochemistry, biophysics and materials research. Photoluminescence spectrometers provide the ultimate blend of high performance, reliability, ease-of-use, durability and versatility.



Optical Path Schematic of Photoluminescence Spectrometer

PerkinElmer LS 45 Photoluminescence Spectrometer

Description

The Perkin Elmer LS 45 Luminescence Spectrometer has been developed in conjunction with a host of software and accessories to address a wide range of applications that require challenges in fluorescence, phosphorescence, chemi or Bio- luminescence. This instrument uses a high energy pulsed xenon source for excitation to minimize photo bleaching of samples and provide a long live excitation source. The Spectrophotometer can be calibrated by using a standard fluorescent material.

The Luminescence spectrometer offers versatility, reliability and ease- of- use. This is an instrument with all of the heritage, sensitivity and reliability.

This Monochromator based instrument uses a high energy pulsed xenon source for excitation. The software combines the user friendly appeal of a Windows based software package with application specific knowledge. The result is a powerful system that can be used routinely for quality fluorescence analyses.

Instrument Details

Model	**LS 45 Spectrofluorimeter**
Optics	**Excitation 200 – 800 nm; Emission 200 – 650 nm**
Wavelength Accuracy	**+1nm**

Applications

Because of its greater sensitivity, fluorescence spectroscopy has many applications, it is increasingly employed for the identification of compounds and conformational studies, it is a powerful technique for studying the dynamical properties of biological molecules in solution. Fluorescence life time measurements can be used to obtain structural information on the fluorescing species and on kinetics of energy transfer.

List of Charges with effect from April 1, 2021			
S.No.	**Facility**	**Educational Institutions**	**Industries**
1	FTIR-ATR Spectrum per Sample	**Rs. 275/- per test**	**Rs. 825/- per test**
2	UV-Vis Spectrometer per Sample	**Rs. 250/- per test**	**Rs. 750/- per test**
3	Luminescence Spectrometer per Sample	**Rs. 250/- per tesr**	**Rs. 750/- per test**

Research Outcomes of SAIF-SPIHER

SAIF-SPIHER, a sophisticated instrumentation facility is a dedicated laboratory to learn the property of any advanced material with the molecular spectroscopic aid. Although, SAIF-SPIHER has vested its interest in exploring smart nano materials, diagnosing diseases in early stages through skin, hair, blood & nails, monitoring the standard of the available commodities and finding the applications of the discovered materials. SAIF-SPIHER strongly believes in upgrading the society through research and has made no compromise with the useless data oriented research.

With the available facilities of SAIF-SPIHER, research scholars of SAIF have published more than **200 research papers** in reputed, high impact factor international journals and have earned **cumulative impact factor as 203**. So far, **5 Ph.D. scholars** from SAIF-SPIHER has successfully completed their research programme.

SAIF-SPIHER serves better to benefit the society through applicable findings in the

following ways.

- SAIF-SPIHER takes a pride in finding a cost effective water purifier, made up of Cellulose Nano Fibrils (CNFs), extracted at SAIF-SPIHER, to remove the radioactive pollutants in the ground water. The purifying ability of the fibrils was determined using PL spectroscopic technique at SAIF-SPIHER.

- The standard of CNFs obtained from wood and non-wood plant precursor resources is understood with spectral impressions exhibited at FTIR-ATR and Fourth derivative FTIR-ATR spectroscopic techniques. SAIF-SPIHER has made a great achievement in differentiating the cellulose obtained from wood and non-wood plant fibers using FTIR-ATR technique.

- Photo-thermally durable papers were made using CNFs at SAIF-SPIHER and the stability of the fibers was learnt by deploying FTIR-ATR and UV-Vis DRS/DTS spectroscopic techniques.

- Another milestone by SAIF-SPIHER is diagnosing and monitoring diseases through skin, hair, blood and nails. SAIF-SPIHER had a successful innings in monitoring the efficacy of Metformin Hydrochloride through hair in diabetic patients by using FTIR-ATR technique.

- SAIF-SPIHER with the versatile FTIR-ATR spectrophotometer is able to discriminate clearly the breast cancer hair tissue from the normal hair tissue.

- SAIF-SPIHER is successful in deploying blood, hair and nail tissues as probes to diagnose asthma and to monitor the efficacy of asthmatic drugs by FTIR-ATR and UV-Visible spectroscopic techniques.

- Various kinds of anemia are discriminated from normal blood, hair, skin and nail tissues by FTIR-ATR and UV-Visible spectroscopic techniques. SAIF-SPIHER is restless to do more, than just diagnosis anemia, so it has started monitoring the efficacy of the treatment using molecular spectroscopic techniques.

- SAIF-SPIHER has exhibited its smartness in diagnosing thyroid, monitoring the efficacy and also in exploring the molecular composition of the traditional ayurvedic drug involved in treating the thyroid.

- Tracking the efficacy of ayurvedic drugs in treating Athlete’s foot is made in ease with FTIR-ATR housed at SAIF-SPIHER.

- Apart from disease diagnosis, SAIF-SPIHER has strongly proved its versatility in determining the opportunities of vermiculite as a best weathering material could be employed in civil constructions.

- SAIF-SPIHER has contributed a lot more in synthesizing and characterizing the metallic nano particles.

- SAIF-SPIHER has played a major role in unveiling the mysteries of nyctinastic and non-nyctinastic movements of two different tamarind leaves using FTIR-ATR technique.

- The complete photo absorption in the UV region of *Pongamia* leaves is determined using UV-VIS DTS spectroscopic technique available at SAIF-SPIHER.

- SAIF-SPIHER extended its assistance in finding the lower glycemic index of millets and traditional rice varieties by using FTIR-ATR spectroscopic technique.

- SAIF-SPIHER made quite a stir in disclosing the inedible polyethylene coatings over the fruits, paper cups and imitation paper banana leaves through FTIR-ATR spectral signatures.

SAIF-SPIHER humbly marching towards finding more for the society, to practice the research approach for global reach.

Events Organized by SAIF-SPIHER

NWAIT'15

SAIF-SPIHER has organized a National Workshop on Analytical Instrumentation Technique – 2015 (NWAIT'15), a grand scientific event was organized to create awareness and hands on training to the researchers about the advanced reflectance spectroscopic techniques to characterize the new materials. **Dr. V. Ravichandran,** Vice Chancellor, SPIHER delivered the Presidential Address. **Dr. R. Jayavel,** Director (Research), Anna University inaugurated the workshop. Around 150 participants have got benefitted with the Lectures delivered by **Dr. S. Gunasekaran**, Dean (R&D), St. Peter's Institute of Higher Education & Research and **Dr. G. Anbalagan**, Professor, Department of Nuclear Physics, University of Madras, over ATR- A Fortune to FTIR Spectroscopy for Materials Characterization and UV-Visible Spectroscopy for Materials Characterization. In continuation to the lectures, experimental demonstrations were made at SAIF-SPIHER.

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Veteran Scientists' Visit to SAIF-SPIHER – February 2016

As SAIF-SPIHER is housed with light based spectrophotometers, it has organized an International Conference on Recent Advances in Applied Sciences (ICRAAS 2016) by commemorating the International Year of Light and Light Based Technologies celebrated during the year 2015. During ICRAAS'16, veteran Scientists and Spectrophysicists **Prof. Dr. K.P. Rajappan Nair** (India/Germany) and **Dr. Lalji dixit** (India) lead team of foreign scientists, **Dr. Jens-Uwe-Grabow** (Germany), **Dr. Thomas Giesen** (Germany), **Dr. Michael**

Schmidtt (Germany), **Prof. Irena Kostova** (Bulgaria), **Prof. Danka Obreshkova** (Bulgaria), **Prof. Jiban Podder** (Bangladesh), **Prof. Zainul A. Siddique** (Bangladesh), have visited SAIF-SPIHER and rejoiced the real-time applications of Attenuated Total Reflectance in FTIR Spectroscopy. Scientists have also made many suggestions and idea to the research scholars of SAIF-SPIHER about the utilization of reflectance and derivative spectroscopy. Nine eminent Scientists have been awarded on behalf of ISPA during the ICRAAS 2016. **Veteran Scientists Award** have been honoured to **Dr. S. Mohan (India)** and **Dr. S. Santhamma (India)**, **ISPA Life Time Achievement Award** have been honoured to **Dr. M N Ponnusamy (India)**, **Dr. K P Rajappan Nair (India)**, **Dr, Lalji Dixit (India)**, **ICRAAS 2016 Awards** have been honoured to **Dr. Jibban Podder (Bangladesh)**, **Dr. Jens-Uwe-Grabow (Germany)** and **Dr. Debashish Bhattacharya (India)** and **ISPA Dr. S. Gunasekaran Award** has been awarded to **Dr. Irena Kostova (Bulgaria)**.

One Day Program on Photonics 2016

With the rich background of having sophisticated light based instrumentation facility, SAIF-SPIHER in association with Vigyan Prasar, has jointly organized a One Day Programme on Photonics on 27 October 2016 at St. Peter's Institute of Higher Education and Research (SPIHER), to commemorate the declaration of Speed of Light as 299,792.458 km/s by the General Conference of Weights And Measures on 21 October 1983 with Vigyan Prasar. **Dr. V. Ravichandran**, Vice Chancellor, SPIHER delivered the Presidential Address. **Dr. T. V. Venkateswaran**, Scientist, Vigyan Prasar inaugurated the Programme on Photonics. School students receive the certificates for outstanding performance. **Dr. T V Venkateswaran** and **Dr. S. Gunasekaran** gave an thought provoking speech on photonics. SPIHER is the only institute in Tamil Nadu to get the opportunity to organize One Day Program on Photonics for school students. It has created awareness to the students about the deployment of Light based technologies.

Internship Programme for PG Students for the Academic Year 2018 - 2019

SAIF-SPIHER organizes a 21 day Internship programme for I PG students (Physical & Chemical Sciences) of various colleges. This programme fillips the young students to take up their project work with deeper understanding over characterization techniques. **Dr. Francis C Peter,** Vice Chancellor, SPIHER inaugurated the internship programme. **Dr. S. Gunasekaran** delivered the importance of the internship programme with an inspiring speech. The internship programme offers the theoretical and experimental knowledge on spectroscopic techniques and Group theory. The working principle and applications of FTIR-ATR, UV-Vis DRS/DTS and PL spectroscopic techniques will be taught to the participants. The Internship programme will be organized during every academic year in the month of May. The participants who are attending the programme for 21 days without fail will be accredited with a

certificate.

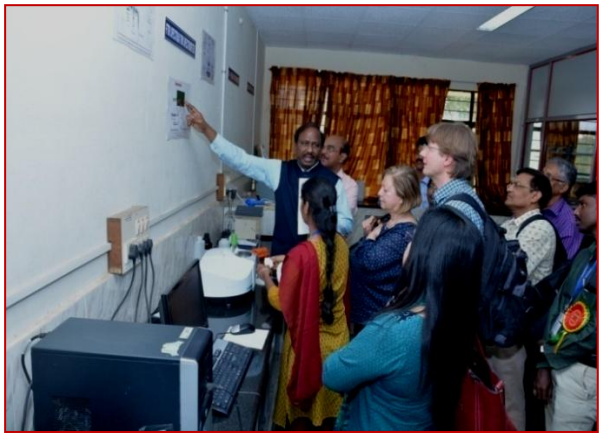
WAIT 2019

SAIF-SPIHER has organized a Workshop on Analytical Instrumentation Technique – 2019 (WAIT 2019), a grand scientific event was organized to create awareness and hands on training to the researchers about the advanced reflectance spectroscopic techniques to characterize the new materials. **Dr. Francis C Peter**, Vice Chancellor, SPIHER delivered the Presidential Address. **Dr.C J Jayashankar,** Professor, Andhra University inaugurated the workshop. **Dr. G. Anbalagan**, Professor, University of Madras and **Dr. S. Kumaresan**, Professor, Arignar Anna Government Arts College delivered the Special Address. Around 70 participants have got benefitted with the Lectures delivered by **Dr. C J Jayasankar**, Professor, Department of Physics, Andhra University, Tirupathi, **Dr. S. Gunasekaran**, Dean (R&D), St. Peter's Institute of Higher Education & Research and **Dr. G. Anbalagan**, Professor, Department of Nuclear Physics, University of Madras, over ATR- A Fortune to FTIR Spectroscopy for Materials Characterization, UV-Visible Spectroscopy for Materials Characterization and Photoluminescence Spectroscopic technique. In continuation to the lectures, experimental demonstrations were made at SAIF-SPIHER.

National Workshop on Analytical Instrumentation Techniques (NWAIT 2015), 25.09.2015

Dr. V. Ravichandran, Vice Chancellor, SPIHER delivered the Presidential Address. Dr. R. Jayavel, Director (Research), Anna University inaugurated the workshop. Dr. S. Gunasekaran and Dr. G. Anbalagan delivered Special lecture on Instrumentation Techniques to researchers and students. Experimental demonstrations were done by the SAIF research scholars.

Scientists Visit to SAIF-SPIHER 12-02-2016



Prof. Dr. K.P. Rajappan Nair (India/Germany) and Dr. Lalji dixit (India), Dr. Jens-Uwe-Grabow (Germany), Dr. Thomas Giesen (Germany), Dr. Michael Schmidtt (Germany), Prof. Irena Kostova (Bulgaria), Prof. Danka Obreshkova (Bulgaria), Prof. Jiban Podder (Bangladesh), Prof. Zainul A. Siddique (Bangladesh) visited SAIF-SPIHER and explored the real-time applications of Attenuated Total Reflectance in FTIR Spectroscopy

ICRAAS 2016 Awardees

Veteran Scientist Awardees

Dr. S. Mohan
India - 2016

Dr. C. Santhamma
India - 2016

Life Time Achievement Awardees

Dr. M. N. Perumsamy
India - 2016

Dr. K. P. Rajappan Nair
India - 2016

Dr. Lalji Dixit
India - 2016

ICRAAS 2016 Award

Dr. Jiban Podder
Bangladesh

Dr. Jens-Uwe Grabow
Germany

Dr. Debasish Bhattacharya
India

ISPA Dr.S. Gunasekaran Awardee

Dr. Irena Kostova
Bulgaria - 2015

One day Programme on Photonics 21-10-2016

Dr. V. Ravichandran, Vice Chancellor, SPIHER delivered the Presidential Address. Dr. T VVenkateswaran, Scientist, Vigyaan Prasar inaugurated the Programme on Photonics. School students receive the certificates for outstanding performance. Dr. T V Venkateswaran and Dr. S. Gunasekaran gave an thought provoking speech on photonics

Internship Programme for M.Sc. Students for the Academic year 2017 – 18 (14 – 31, May 2018)

Dr. Francis C Peter, Vice Chancellor, SPIHER inaugurated the internship programme. Dr. S. Gunasekaran delivered the importance of the internship programme with an inspiring speech

Workshop on Analytical Instrumentation Techniques (WAIT 2019)
04-03-2019













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