

Criterion-4

Infrastructure and Learning Resources

Add Tables for IT infrastructure related to computers and class rooms (4.3.1 and 4.2.2 Library service)

INFRASTRUCTURE AND LEARNING RESOURCES

FACILITIES

Computer Laboratory

There are 25 computers in Computer Lab for students to learn various software programmers like C, C++, and FORTRAN etc. Internet facilities are also provided to the Ph. D. students.



Departmental Library

In department there is one library, which has a large collection of books. PG students (M.Sc. /Ph.D.) as well as faculty members are availing the facility of library. Library is well equipped with nationally and Internationally recognized publishers books. Department has an up-to-date and well-maintained library consisting of more than 4000 books in various branches of Physics, Electronics and Computer for students and faculties.



Departmental library

Workshop and Glassblowing Room

There is one workshop where all designing of instruments for research purpose is performed. The workshop is well equipped with various machines such as Lathe-machine, Drilling, Shaper grinder, Sheet cutter, Milling and Glass Blower, Welding machine for research and laboratories maintenance.

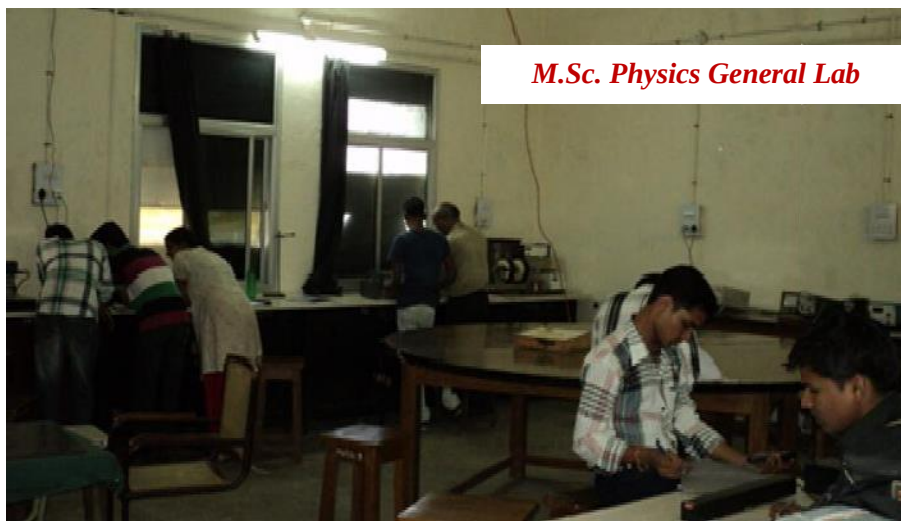
Some other tools which are used for engineering purpose are also available in workshop. Moreover, there are machines in glassblowing room for preparation of glass items like capillaries, flask, glass tubes etc. With such infrastructure the research activities are going on in the various areas.



Workshop

UG & PG Practical Laboratories

There are three (1st year, 2nd year and 3rd year Lab) well equipped laboratories for under-graduate students and four (General Lab, Communication Lab, Electronics Lab, Microprocessor Lab) for post-graduate students.



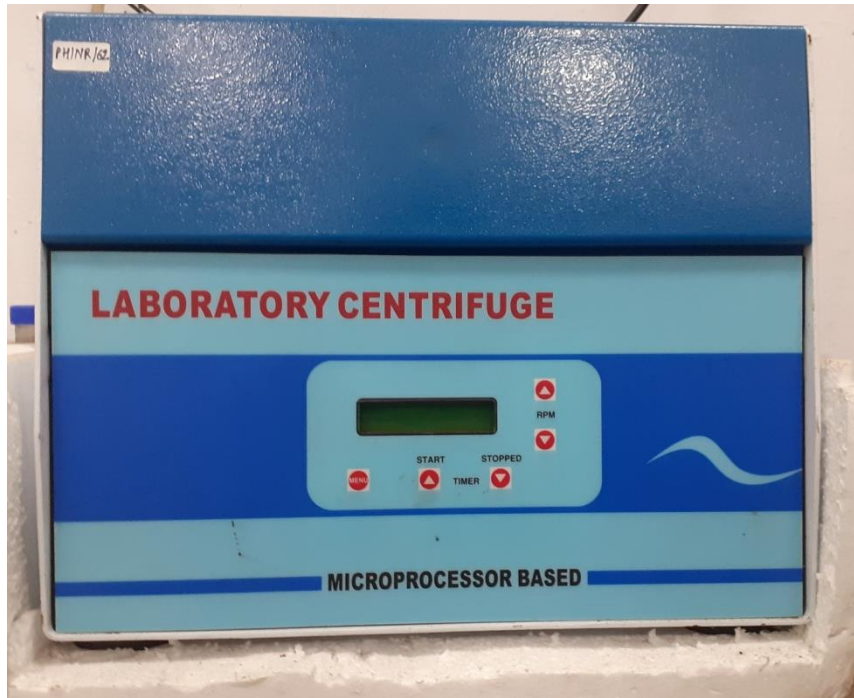
DEPARTMENTAL FACILITIES FOR RESEARCH WORKS

FLUORESCENCE SPECTROMETER:

Fluorescence spectrometer (Model name Fluoromax-4) working in the wavelength range from 200 nm to 1100 nm. The spectrometer can be used to record excitation spectra and emission spectra. The instrument can also be used to record decay profile of the fluorescent material. It works on the principle of back scattering mode. The resolution of the fluorescent spectrometer is 0.5 nm. It can record fluorescence spectra of both solid and liquid sample. In this instrument there are two band pass filter of wavelengths 320 nm, 370 nm and five cut off filter having wavelength 370nm, 399nm, 450nm, 500nm and 550 nm. These filters are used to remove overtones from the emission spectrum. This instrument is used to analyze optical properties of the materials.

Laboratory Centrifuge

A centrifuge machine is an electrical device that separates components in a sample combination, such as a suspended solids mixture or two or more immiscible liquids. The apparatus is attached to the rotational axis, and centrifugal forces divide the samples, causing the denser materials to sink below the lighter ones. The sample is enclosed in conical or round tubes, which are commonly referred to as centrifuge tubes, and put into the rotor, in a balanced position, and covered with a lid to avoid spills, accidents, or disasters. The rpm (rotation per minute), i.e. centrifugal speed, the duration of rotation, based on the sample requirement. The laboratory centrifuge machine is available in lab as non-refrigerated, microprocessor based low to high rpm speed as high as 10000 rpm.



Microwave oven

Microwaves have long been utilised in research laboratories to speed up the sample preparation procedure. Microwaves are the only heating technology that does not rely on thermal conduction. Microwaves penetrate several centimetres deep and disperse the energy they transport to the material's heart, whereas infrared is absorbed on the material's surface. The sole need is that the material isn't an excellent electrical conductor. Our Domestic microwaves are used for sample preparation and other laboratory processing. Operates upto 900 Watts.



Vacuum oven

Laboratory vacuum ovens are popular in electronics, materials processing, forensic, and research laboratories. In general, these vacuum ovens provide an inert environment, precise temperature control, and consistent temperatures throughout the heating process. Annealing, die-bond curing, drying or dehydrating, Polyimide baking, sterilizing, and evaporating are just a few of the typical uses for laboratory ovens.



Autoclave

An autoclave is a machine that is used to perform industrial and scientific operations that need higher temperatures and pressures than the ambient pressure and temperature. In research, autoclaves are used to synthesise materials, and in the chemical industry, they are used to cure coatings, vulcanize rubber, and perform hydrothermal synthesis. Maximum operating temperature upto 200°C.



High Temperature vertical furnace

It is vertical type of furnace. A muffle furnace is a furnace in which the subject material is isolated from the fuel and all of the products of combustion, including gases and flying ash. After the development of high-temperature heating elements and widespread electrification in developed countries, new muffle furnaces quickly moved to electric designs. It can go up to maximum 900 °C. It is useful for Combustion, calcinations, annealing and sintering of samples.



Magnetic stirrer

A magnetic stirrer or magnetic mixer is a laboratory device that employs a rotating magnetic field to cause a stir bar (or *flea*) immersed in a liquid to spin very quickly, thus stirring it. The rotating field may be created either by a rotating magnet or a set of stationary electromagnets, placed beneath the vessel with the liquid. It is used in chemistry and biology where other forms of stirring, such as motorized stirrers and stirring rods, may not be viable for use.



Digital balance

Digital electronic weighing scale is a device used to measure mass or weight. It works with the use of a strain gauge load cell. If you see the analog scales, it uses springs to indicate the weight of the object, while digital scales convert the force of a weight to an electric signal.



Ultrasonicator

Ultrasonic cleaning is a process that uses ultrasound (usually from 20–40 kHz) to agitate a fluid. The ultrasound can be used with just water, but use of a solvent appropriate for the object to be cleaned and the type of soiling present enhances the effect. Cleaning normally lasts between three and six minutes, but can also exceed 20 minutes, depending on which object has to be cleaned.



Solid State Ionics Laboratory

Vacuum Oven

Korean made oven (OV-11) with the facility of creating vacuum for drying samples in an inert atmospheres. There is an attachment for drying in an atmosphere of specific gas. Used for the drying different materials such as thin films, nanopowders, composite materials.

- Temperature range: R.T. -300°C.
- Vacuum upto-0.1 MPa.
- Facility of time controlling.
- Facility for drying multiple samples simultaneously.



Planetary ball milling machine (Pulverisette 7)

Planetary ball Milling is a machine used for fine grinding of hard, medium-hard, soft, brittle, tough and moist materials. The comminution of the material to be ground takes place primarily through the high-energy impact of grinding balls in rotating grinding bowls. The grinding can be performed dry, in suspension or in inert gas. In addition to comminution, Planetary Milling can be used for mixing and homogenising of emulsions and pastes or for mechanical alloying and activation in materials research.

specifications

- Maximum rotation speed 800 rpms
- Maximum repetitions 99
- Agate and stainless steel pots of 30 ml capacity



ELECTRONIC BALANCE

Electronic balance is used to measure quickly and accurate weight of Substance. It is especially important in experiments that require precise amount of each substance to achieve the desired result. Laboratory electric balance provides digital result of measurement.

1. Model- MAB 220

Range – Max. 220g to Min.0.1mg



Unit – gram, OZ, ct ,lb, dwt, CN, %

2. Model – MP-300G

Range – Max. 31.0g to Min.0.001g

Unit – gram

High Temperature furnace

Furnace is an instrument used to provide high temperature for calcinations, annealing or sintering of samples. Our lab contains a high temperature furnace which provides temperature in the range 30°C to 1500°C.

- Silicon carbide heating element
- Range from r.t.- 1500°C.



Spin Coater

For the fabrication of thin film on different substrates. Used for the research related to optical properties, electro-optical properties etc. Initial precursor for this instrument must be in the of gel.

- Controlled by microprocessor
- Facility of vacuum for holding substrate
- Digital display
- Max. R.P.M. 10000



Hydraulic press

Hydraulic press is an instrument which is used to make pellets of powder sample. Specifications:

- Evacuatable Die
- Pellet Holder (diameter 13 mm)
- Adjustable Adapter
- Adjustable pressure control (1-100 Mpa)



Hot Plate Magnetic Stirrer

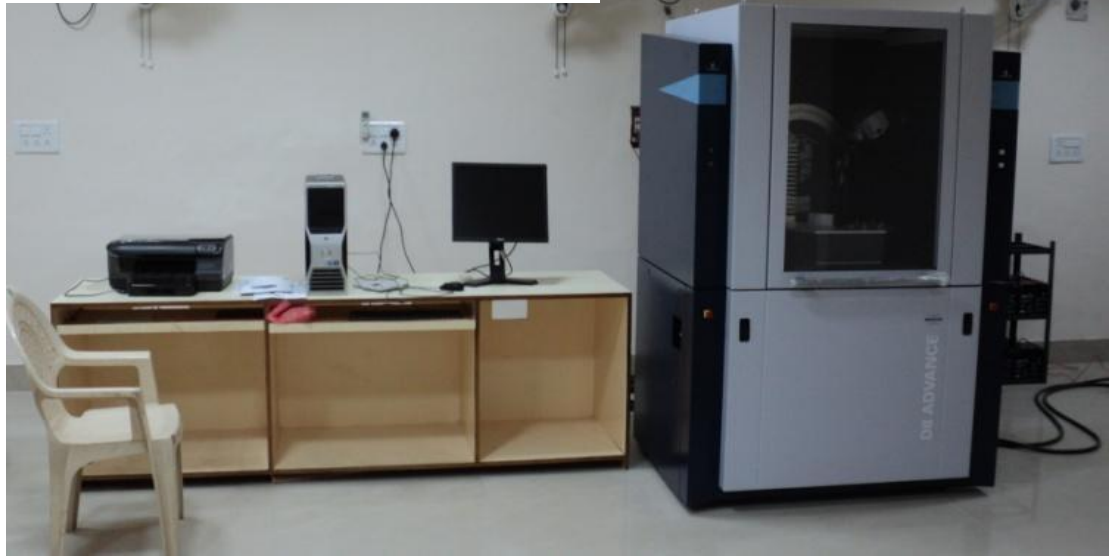
For the synthesis of different materials such as composite, gel for thin films, nanoparticles. Added with the facility of Hot plate upto the temperature of 250-300C

- Magnetic stirring
- RPM 500
- **Central Facilities at Department of Physics under SIC**



- **X-Ray Diffraction (XRD)**
- The XRD is nondestructive and is usually used to determine crystal structures of different materials such as metals and alloys, minerals, inorganic compounds, semiconductors, thin-film coatings, ceramics, polymers and organic materials as well as to derive information such as crystallite size, lattice strain, chemical composition, and crystal orientation. The BRUKER D8 ADVANCE X-ray diffractometer is a high precision, vertical type goniometer with theta/theta configuration that is configured for analysis of powder samples and thin films. This instrument is equipped with a Cu x-ray tube, a number of slits and filters, spinning sample stages with variable speed option with the provision for doing 30 samples one by one and NaI scintillation crystal detector. It is used for routine identification of unknown materials, quantitative phase analysis, structure determination, cell refinement work, and other applications. The movement of theta-2theta and theta-theta arms is controlled with stepper motors and optical encoders providing smallest step size of 0.0001 degree with angular range of $110 < 2\theta < 165$ degree. The D8 diffractometer unit houses the diffraction goniometer assembly, x-ray tube, high voltage power supply, cooling water circuit, and intelligent electronics system that is used to monitor and run the equipment.

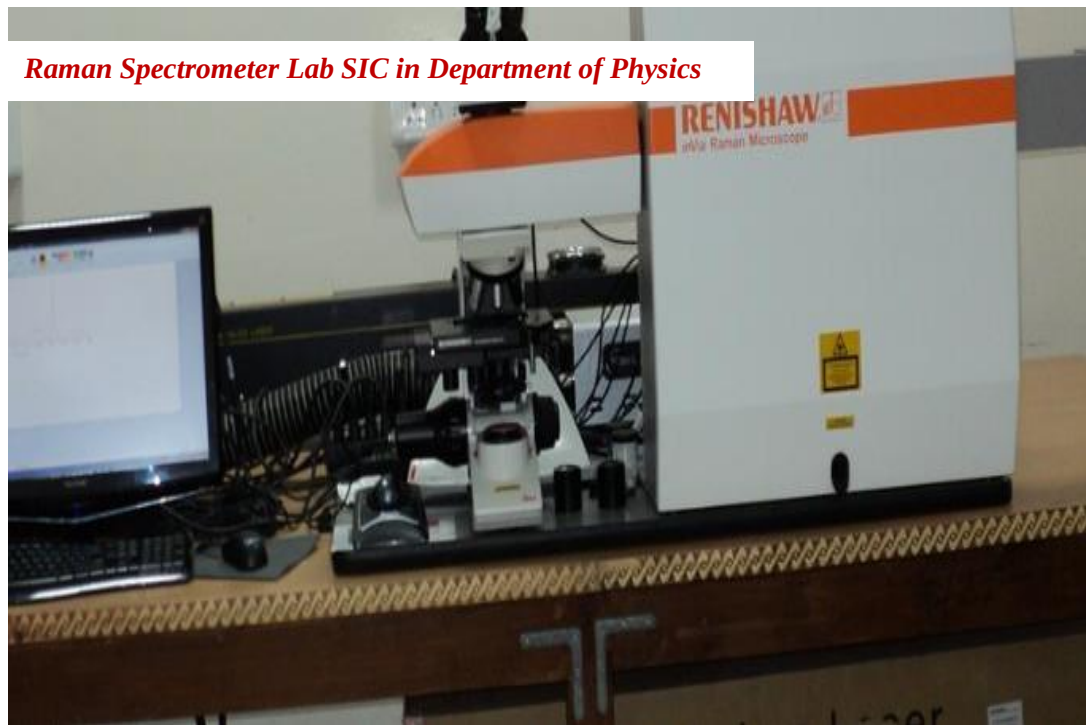
XRD Lab under SIC in Department of Physics



- **Micro Raman Spectrometer**

- Micro Raman Spectrometer integrated with He-Ne Laser (633nm), Ar Laser (514nm) & He- CD Laser (325nm) with CCD detector , micro thermometric cell
- along with supporting
 - software for analysis of whole range of semiconductor
- materials with wide band gaps, Identification of polymers, polymer blends, gem stones, determination of filling the cracks and flaws, CNT, grapheme. Research and quality control of film and protective coating. Applications in narcotic, explosives, fiber identification, analysis of paint and pigments, gun shots etc, Analysis of pharmaceutical and biological materials ranging from tablets to live cells.

-



-

-

- *Ellipsometer*
- In department we are going to install one spectroscopic ellipsometer, one of the sophisticated instruments of university. It is in form of central facility. The silent
- feature of ellipsometer is, enhanced UV coverage down to 245nm. It is Ideal for many thin films: dielectrics, organics, semiconductors, metals, and more. It
- measures film thickness from sub-nanometers up to tens of microns and the optical properties from transparent to absorbing materials.
-
-



Ellipsometric Spectrometer Lab SIC in Department of Physics

•

- **Nuclear Magnetic Resonance (NMR) Spectrometer**
- In the pulsed Fourier Transform (FT) Nuclear Magnetic Resonance (NMR) spectroscopy, the sample kept in a homogeneous magnetic field is subjected to a strong radio frequency pulse of very short duration and the decay of the signal, called the Free Induction Decay (FID) is monitored. A Fourier Transform of the FID gives the frequency domain NMR spectrum. NMR is used for quality control, purity checking, pharmaceuticals and other chemical industries for structure Identification. It is also used in fundamental research for characterization of chemicals.



-
- **Simultaneous Thermal Analyser**
- STA (Model 449 F1 Jupiter , NETZSCH) , is a combined unlimited configuration flexibility and unmatched performance in just one instrument .Simultaneous thermal analysis generally refers to the simultaneous application of Thermogravimetry (TG) and Differential Scanning Calorimetry (DSC) to one and the same sample in one instrument. The system is fully automatic one can program for 19 sample measurement from room temperature to 1400⁰ C, in N₂/O₂ gas flow atmosphere, with defined heating rate.
- By DSC analysis one can find out, Melting point/crystallization behavior of material, Solid-solid transition, Polymorphism, Degree of crystallinity, Glass transitions, Cross-linking reactions, Oxidative stability, Purity determination, Specific heat determination of samples and by TG analysis one can find, Mass change, Temperature stability, Oxidative /reduction behavior, Decomposition, Corrosion studies etc. for various materials.
-



-
-

- *STA under SIC in Department of Physics*