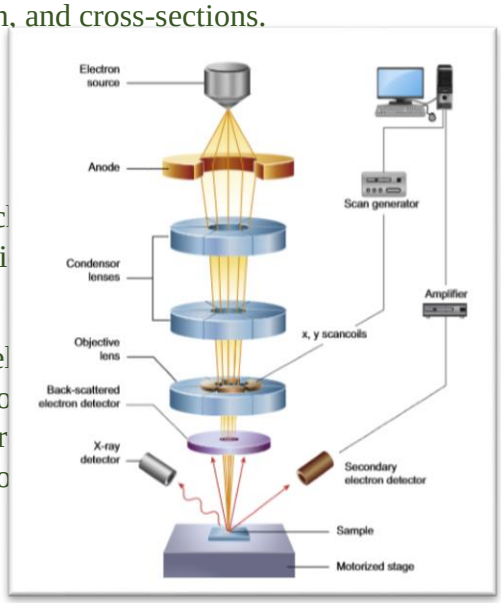
Scanning Electron Microscope with EDS

- Scanning Electron Microscope is essentially a high magnification microscope, which uses a focussed scanned electron beam to produce morphology and elemental composition, with the necessary sample preparation, and cross-sections.
- Primary electrons generate low-energy secondary electrons, which tend to emphasize the topographic nature of the specimen.
- Primary electrons can be backscattered whic produces images with a high degree of atomi number (Z) contrast.
- Ionized atoms can relax by electron shell-to-shel transitions, which lead to either X-ray emission o Auger electron ejection. The X-rays emitted ar characteristic of the elements in the top few µm o the sample and are measured by the EDS detector.



Specific Features of the VEGA3 SEM:

- Fast and precise motorized specimen stages.
- Fully automated microscope set-up.
- Turbomolecular and rotary pumps ensure quick and easy sample exchange and short times to reach a working vacuum.
- This instrument is best suited to imaging and analysis of coated samples that are stable under the electron beam, e.g. rocks, minerals, ceramics, metals, and alloys, but can also image biological materials either coated or uncoated samples in low-vacuum mode.

- Critical Point Drying- to dehydrate biological tissue before examination in the Scanning Electron Microscope.
- Peltier Cooling Stage- it preserves the delicate structure of the biological specimens as close as possible to its natural state by controlling the evaporation using the thermoelectric (Peltier) effect.

Technical specifications

Electron Gun	**Tungsten heated cathode**
Beam Energy	200 eV to 30 kV
Resolution in high-vacuum mode SE In low vacuum mode BSE, LVSTD	3 nm at 30 kV 8 nm at 3 kV 3.5 nm at 30 kV
Chamber vacuum High vacuum	$<9\times10^{-3}$ Pa

Medium vacuum Low vacuum Extended Low vacuum	3–150 Pa 3–500 Pa 3-2000 Pa
Magnification	10x to 5,00,000x
Specimen size	100 mm diameter
Detectors	**SE** (secondary electron detector), **BSE** (backscatter electron detector capable of working in both low and high vacuum mode), **LVSTD** Ionization-based secondary electron detector for detection of secondary electrons in low vacuum/ **CL** detector for detection of antibodies. Semiconductor type Multiview **STEM** detector for doing ultra-structural studies, nano samples, and virology samples.
Electron Column Displaying Modes	Resolution Depth Field Wide Field
Biological samples	Critical point drier Peltier Cooling Stage
Sputtering/ Spraying	Au coating
Elemental analysis	Energy Dispersive X-Ray Spectroscopy (EDS)-Qualitative, Quantitative analysis and Elemental mapping

Sample Requirements and Preparation

Solid Samples:

1) The solid sample should be cut into smaller, manageable pieces. Approx (8mmX8mm) or 8mm Dia
2) Clean the sample surface using an appropriate solvent or ultrasonic cleaning to remove contaminants. Metallic samples need to be polished and etched. Ensure the sample is completely dry.

Powder Samples:

1) Approximately 5-20 mg

Biological Samples:

1) Fix biological samples using suitable fixatives like formaldehyde or glutaraldehyde to preserve cellular structures.
2) Gradually dehydrate the sample using a series of ethanol solutions or other dehydration agents.
3) Perform critical point drying to replace the liquid solvent with a gas, avoiding damage to delicate structures.
4) Ensure the sample is completely dry and apply a thin conductive coating to enhance imaging quality.

Nanomaterials Dispersed in Liquids:

1) The nanoparticles or nanotubes can be dispersed in a suitable solvent to create a well-dispersed solution.

2) A small amount of the dispersed solution should be deposited onto a conductive substrate for imaging. Allow solvent evaporation.
3) Ensure the sample is completely dry, and solvent residues are removed.

*** A thin conductive coating is required to enhance imaging quality, especially for non-conductive nanomaterials. ***

Details of Scanning Electron Microscope with EDS

Brand	TESCAN, Czech Republic
Model	Vega 3
Sponsored Agency	DST- PURSE program (Phase -2)