CONTENT

MICROSCOPES

- **Electron microscope**
  - **Scanning electron microscope**
- **Transmission electron microscope.**

BASIC TECHNICAL TERMS OF A MICROSCOPE

"Microscope is a device used to view the magnified image of a smaller object, which cannot be seen through a naked eye".

- **Microscope**
  - a device used to view the magnified image of a smaller object

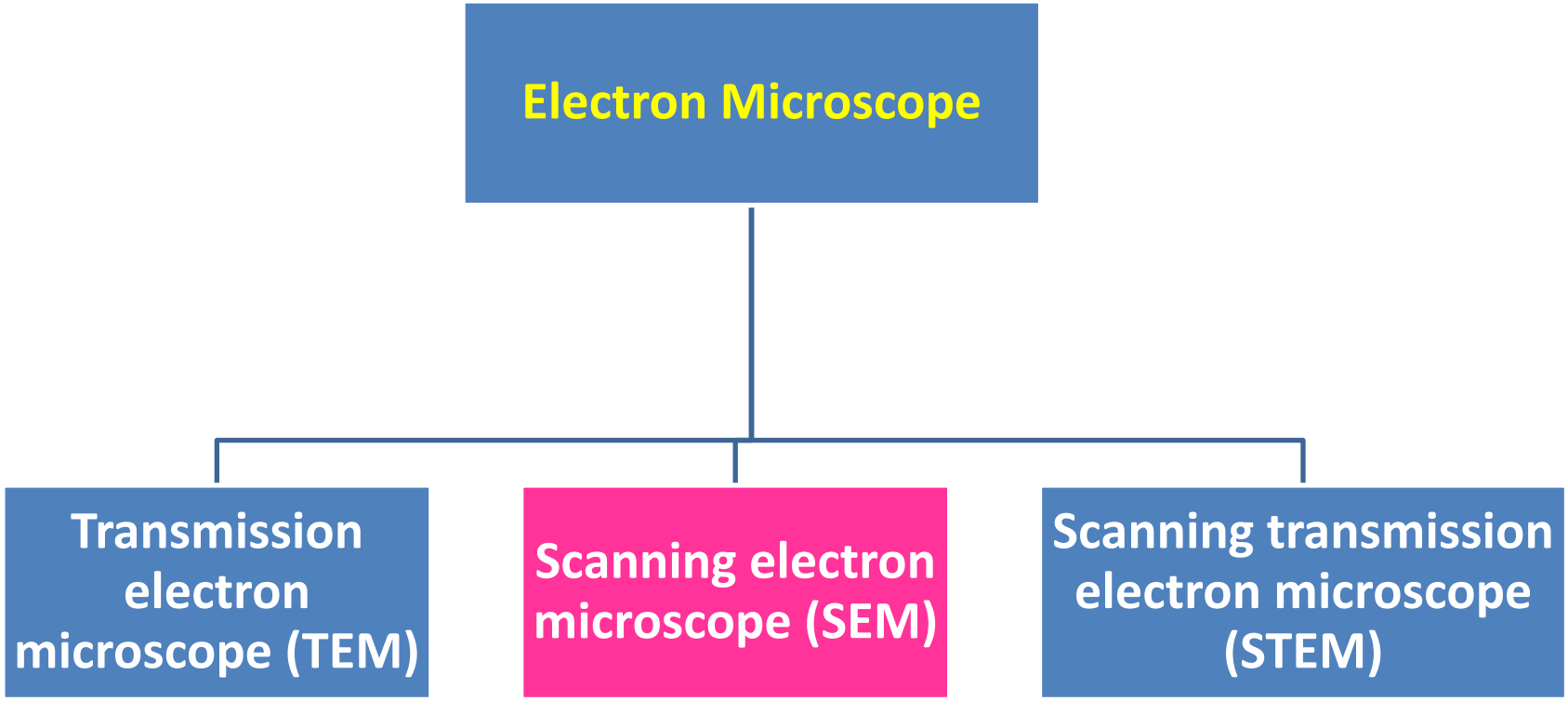
- **Magnification Power**
  - ability of the microscope to show the image of an object in an enlarged manner

$$Magnification\,power = \frac{Angle\ subtended\ by\ the\ final\ image\ at\ eye}{Angle\ subtended\ by\ the\ object\ at\ eye\ placed\ at\ the\ near\ point}$$

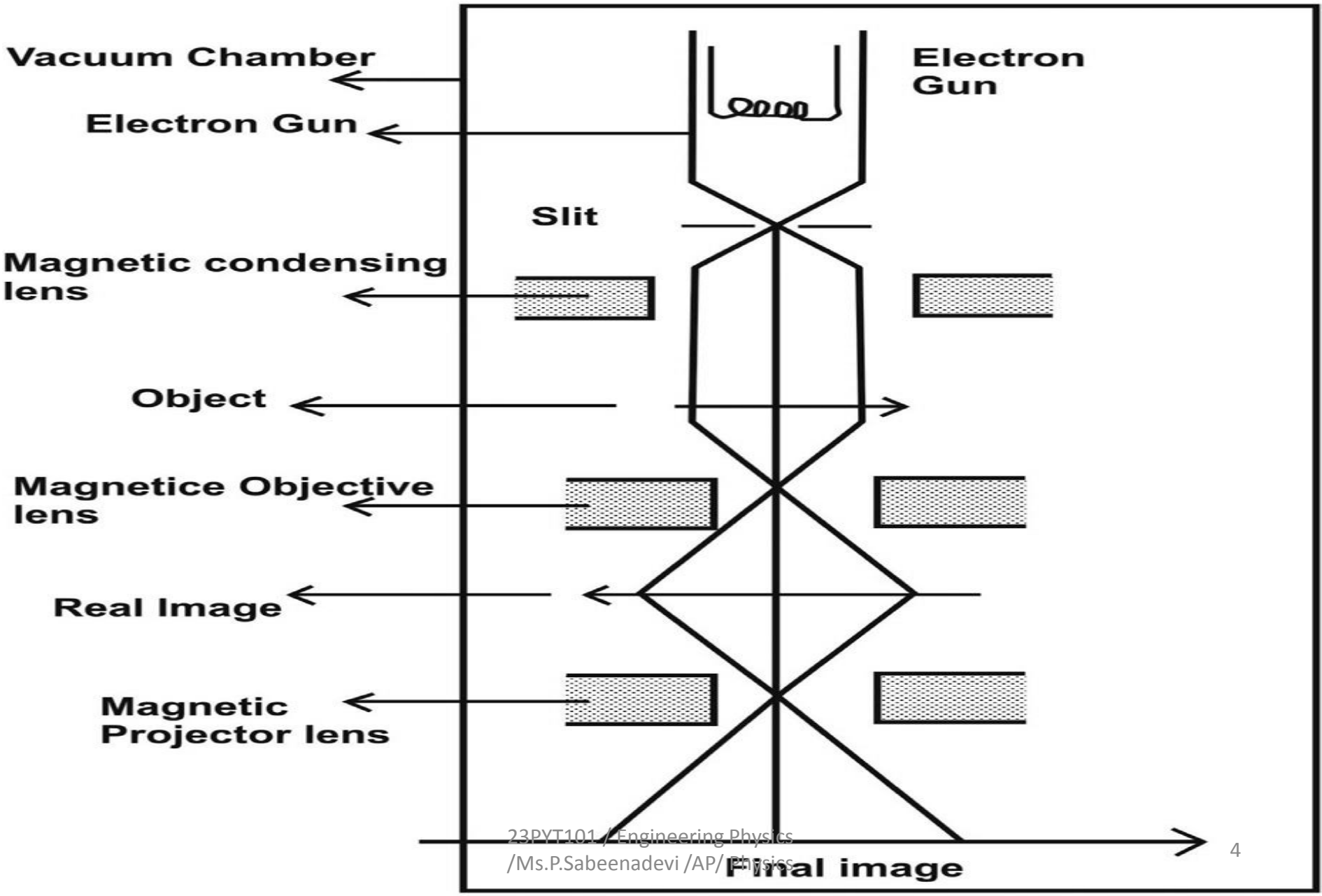
- **Resolving Power**
  - ability of an instrument to form a distinct and separable images of two point objects which are close to each other.

  The resolving power is inversely proportional to wavelength.

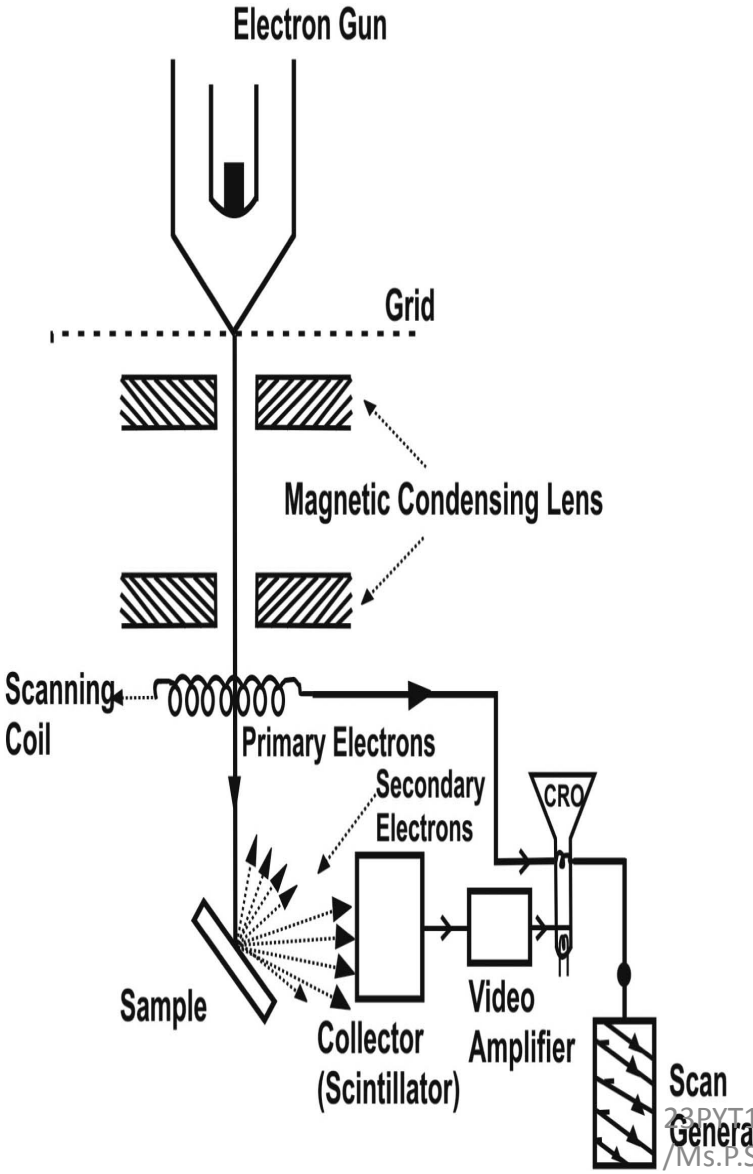
TYPES OF ELECTRON MICROSCOPES



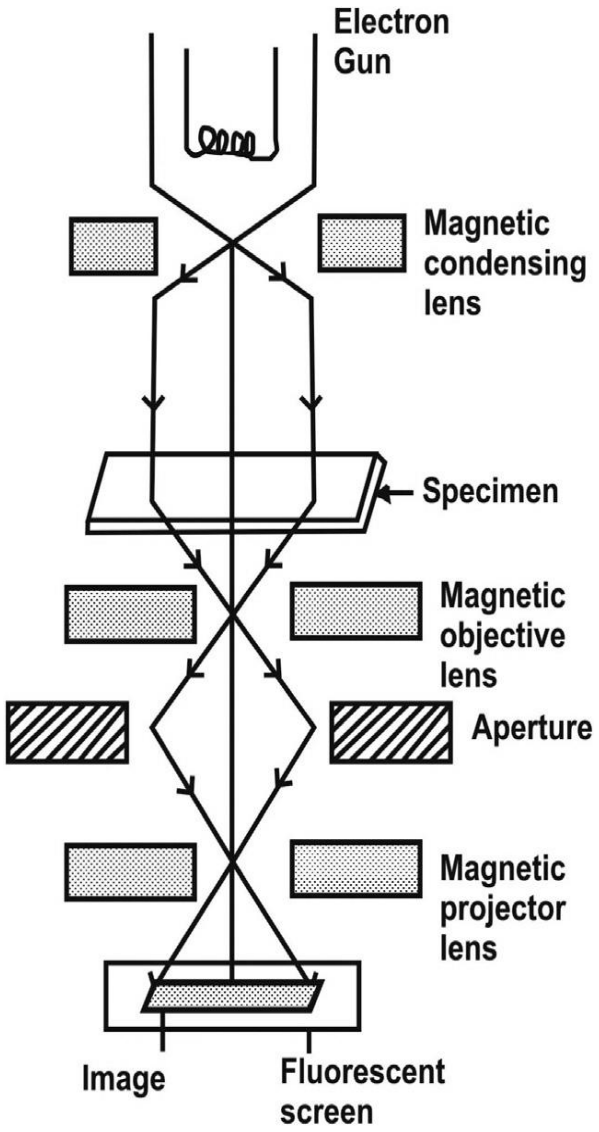
ELECTRON MICROSCOPE



Scanning Electron Microscope



Transmission Electron Microscope



ELECTRON MICROSCOPE

ELECTRON MICROSCOPE

Invention:

- Electron microscope is a marvellous invention. It opens many doors of nano science and technology.

- The electron microscope was invented by the German scientists Ernst Bruche and Max Knoll of the Technical University of Berlin in 1931. The first practical electron

- microscope was constructed by James Hiller and Albert Prebus of the University of Toronto.

ELECTRON MICROSCOPE

Principle:

A stream of electrons are passed through the object and the electrons which carries the information about the object are focused by electric and magnetic fields.

Since the resolving power is inversely proportional to the wavelength, the electron microscope has high resolving power because of its short wavelength.

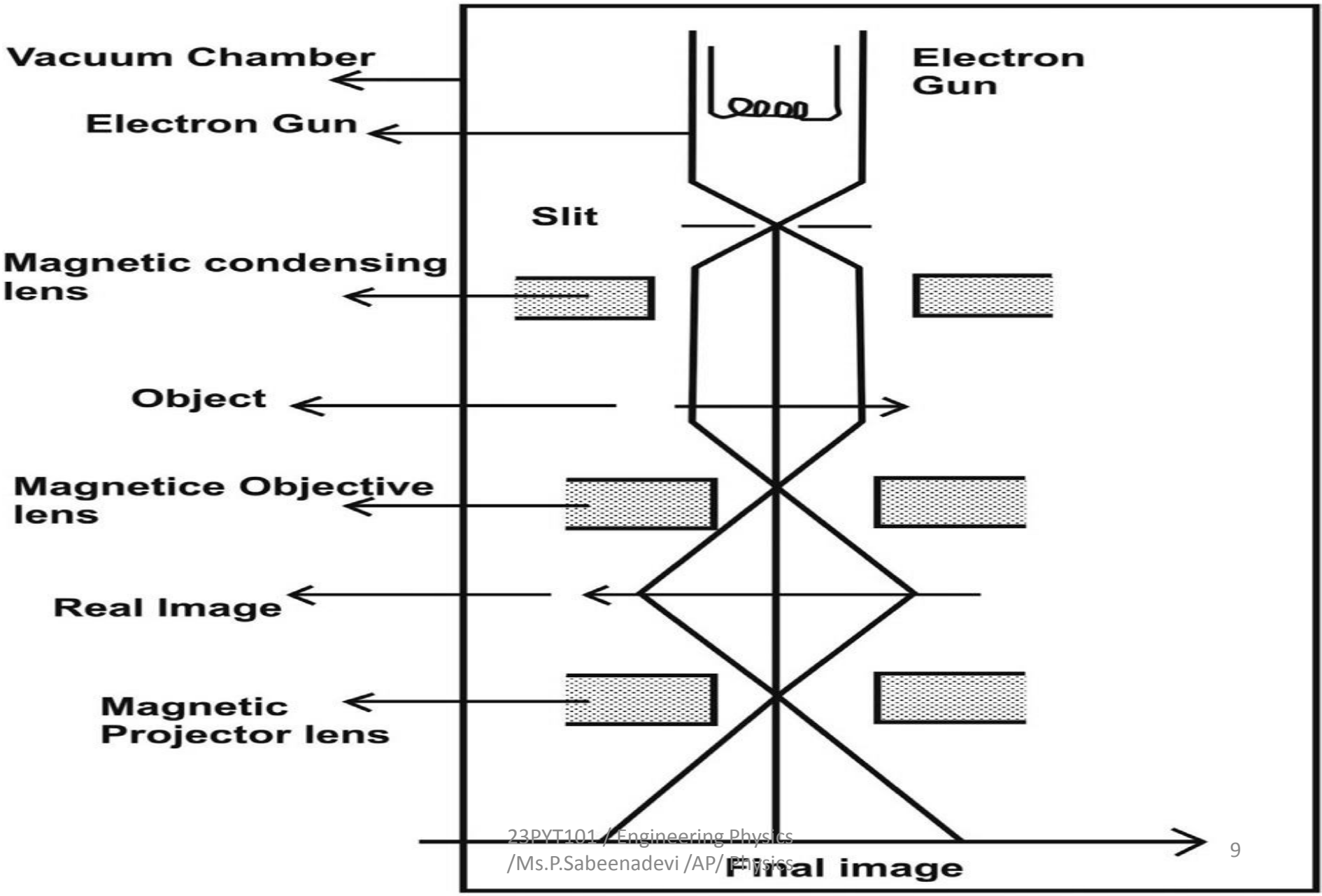
Construction:

The electron microscope is as shown in Figure and the whole arrangement is enclosed inside a vacuum chamber.

Electron microscope consists of the following:

(i) Electron gun (to produce stream of electrons),
(ii) Magnetic lenses (for focusing),
(iii) Fluorescent screen.

ELECTRON MICROSCOPE



ELECTRON MICROSCOPE

Working:

- Stream of electrons are produced and accelerated by the electron gun.
- Using magnetic condensing lens, the Accelerated electron beam is focused on the object.
- Electrons are transmitted in the rarer and denser region of the object.
- Electrons are absorbed in the denser region, The transmitted electron beam falling over the magnetic objective lens resolves the structure of the object.
- The image can be magnified by the projector lens and obtained on fluorescent screen.

ELECTRON MICROSCOPE

Advantages:

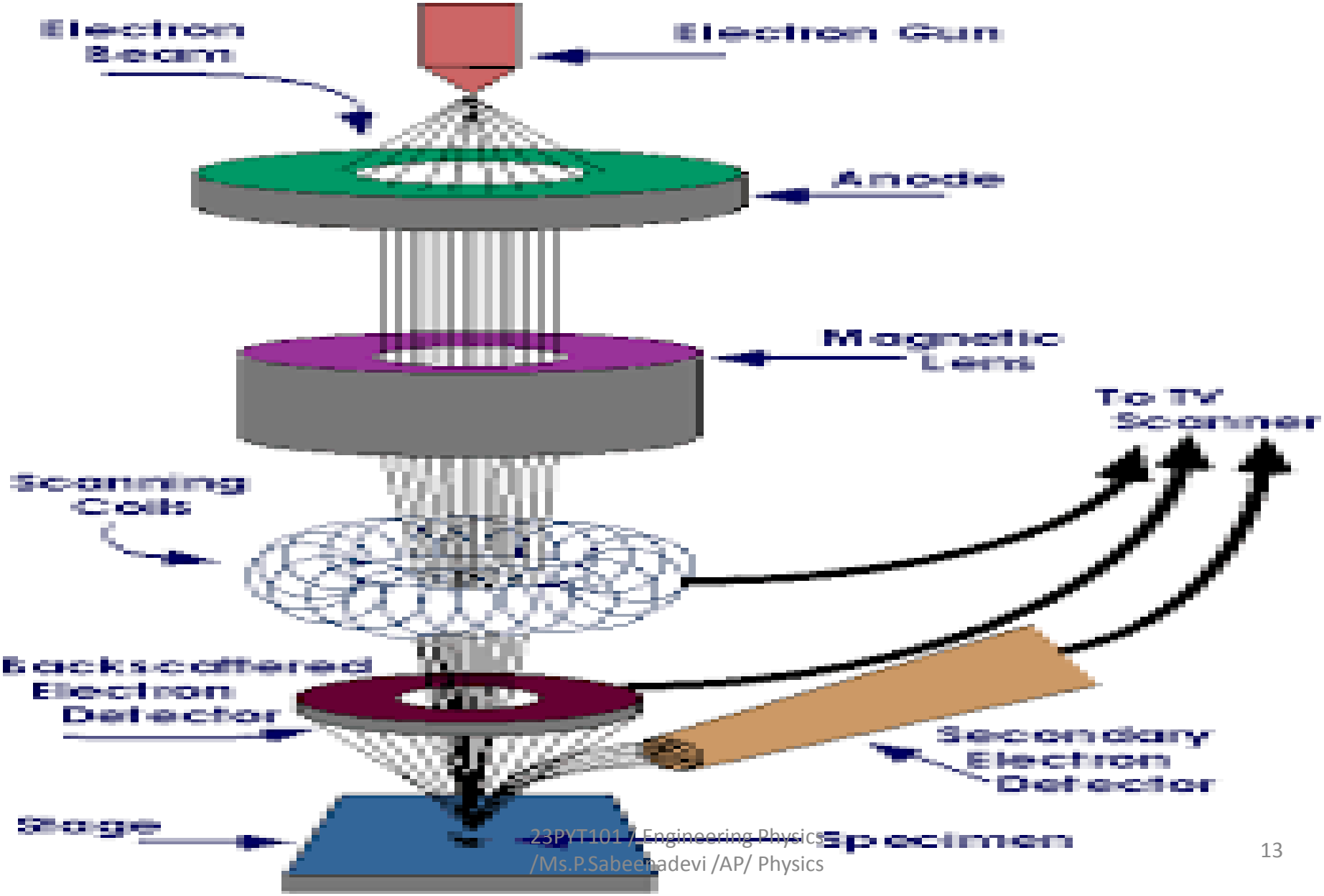
Produces magnification as high as 10^5.

Applications:

- To study the structure of bacteria, virus, *etc.*
- To study the structure of the crystals, fibers.
- To study the surface of metals.
- To study the composition of paper, paints, *etc.*

SCANNING ELECTRON MICROSCOPE (SEM)

SCANNING ELECTRON MICROSCOPE (SEM)



SCANNING ELECTRON MICROSCOPE (SEM)

Principle:

- Accelerated primary electrons are made to strike the object.

  The secondary electrons emitted from the objects are collected by the detector to give the three dimensional image of the object.

Construction:

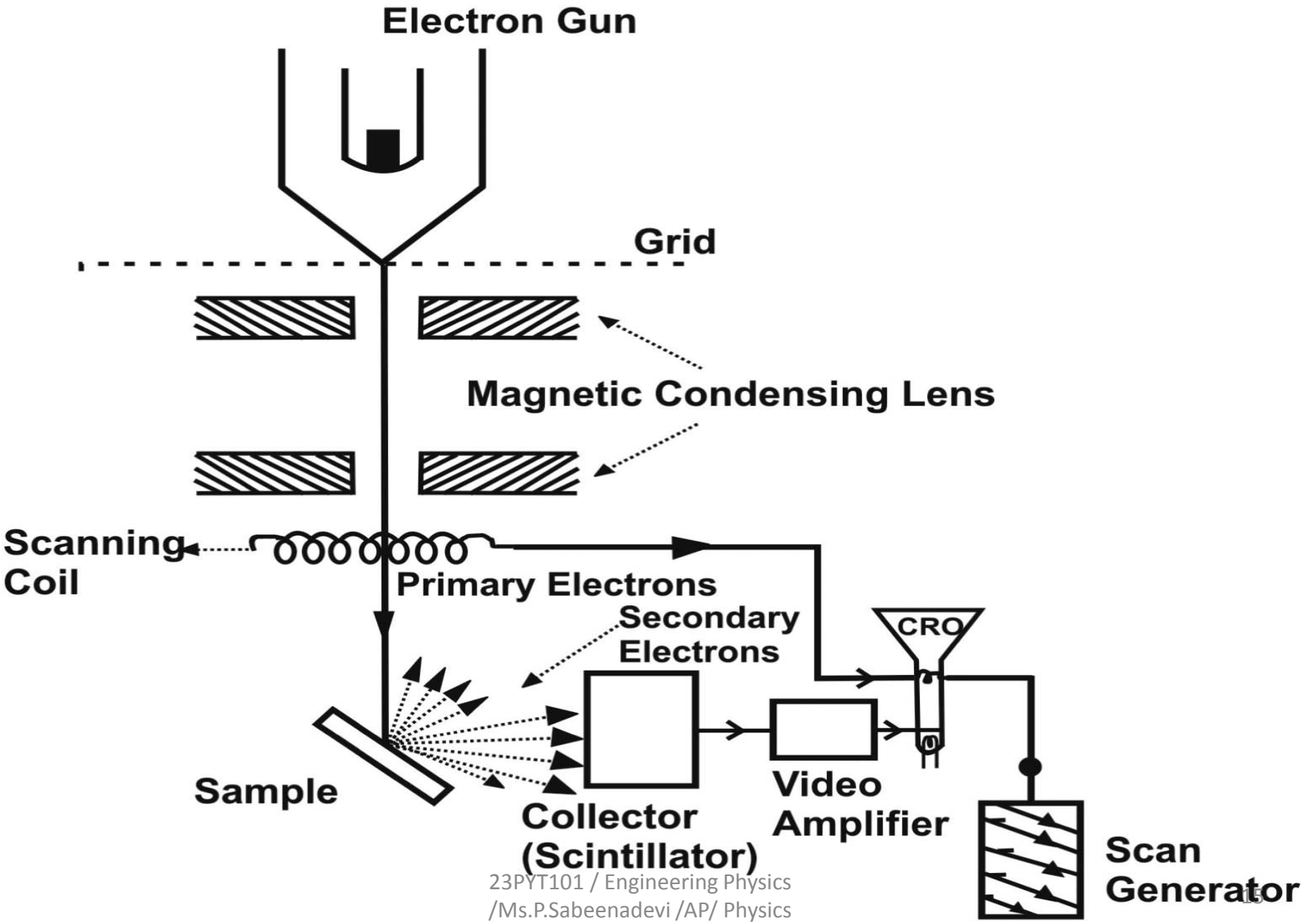
1. Electron gun:

- This produces a high energy electron beam by thermionic emission
- These electrons are accelerated by the anode towards the specimen.

2. Magnetic condensing lens:

- These are coils carrying current.
- The beam of electrons can be made to converge or diverge.
- The focal length can be adjusted by varying the current in the coils
- The electron beam can be focused to a fine point on the specimen.

SCANNING ELECTRON MICROSCOPE (SEM)



SCANNING ELECTRON MICROSCOPE (SEM)

3. Scanning coil:

❑This coil is placed between the condensing lens and the specimen.

❑This is energized by a varying voltage.

❑This produces a time varying magnetic field.

❑This field deflects the beam and the specimen can be scanned point by point.

4. Scintillator:

❑ This collects secondary electrons and converts into light signal.

5. Photomultiplier:

❑The light signal is further amplified by photomultiplier.

6.CRO:

❑Cathode ray oscilloscope produces the final image.