DEPARTMENT OF PHYSICS
PHYSICAL SCIENCES (PHYSICS) LAB
STANDARD OPERATING PROCEDURE

Name of the Lab/ Facility	**Engineering Physics Laboratory**
Name of the Experiment	**YOUNG'S MODULUS - NON-UNIFORM BENDING**
Purpose	To determine the Young's modulus of the material of the given beam by non-uniform bending.
Scope	This SOP describes how to determine the Young's modulus of the material. Young's modulus of the material is intended for getting best mechanical behaviours of the beam available in the laboratory.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE

- Before start, clean and arrange the required apparatus such as Travelling microscope, knife edges, slotted weights, pin, meter scale, screw gauge and vernier calipers.
- The given beam (meter scale) is placed on the knife edges at equal distances from both the ends of the beam.
- A pin is fixed at the middle of the beam and a weight hanger is suspended.
- Adjust the microscope, focus the tip of the pin and made to coincide with the horizontal cross wire, and note the reading.
- The above procedure is repeated by adding slotted weights one by one (50gm) and the corresponding readings are noted (loading).
- The same procedure is repeated by removing slotted weights one by one (50 gm) and the corresponding readings are noted (unloading).
- Using above values, the mean depression "s" is calculated.
- Thickness and breadth of the beam are measured using screw gauge and vernier caliper respectively.
- Hence the Young's modulus of the beam is calculated the using given formula.

Young's modulus $\mathbf{Y = \frac{Mgl^3}{4sbd^3}}$ $\mathbf{Nm^{-2}}$

EXPLANATION OF SYMBOLS

M - Load (Kg)

S - Mean depression for a load M (m)

g – Acceleration due to gravity (ms^{-2})

l – Distance between two knife edges (m)

b – Breadth of the beam (m)

d – Thickness of the beam (m)

CLEANING AND MAINTENANCE

- Clean the all used apparatus after use.
- Travelling Microscope is maintained in good condition on a regular basis according to the manufacturer's instruction.

PRECAUTIONS TO BE FOLLOWED

- Loads added should be within the elastic limit.
- The hanger should be suspended exactly at the midpoint between the two knife edges.
- As the third power of thickness and length of the beam occur in the formula, they should be measured carefully.
- Sufficient loading and unloading should be done before the start of the experiment.

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF PHYSICS
PHYSICAL SCIENCES (PHYSICS) LAB

Name of the Lab/ Facility	**Engineering Physics Laboratory**
Name of the Experiment	**TORSIONAL PENDULUM**
Purpose	To determine the moment of inertia of the disc and the rigidity modulus of the material of wire by Torsional oscillations.
Scope	This SOP describes how to determine the Rigidity modulus of the material. Rigidity modulus of the material is intended for getting best mechanical behaviours of the wire available in the laboratory.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE

- Before start, clean and arrange the required apparatus such as Uniform circular disc, wire, two symmetrical masses, stop clock, screw gauge, and meter scale.
- A thin wire, whose rigidity modulus is to be measured, is fixed between a wall bracket and the disc.
- Set up the Torsional oscillations by means of couple of forces.
- Period of oscillations for without mass, with mass at the closest distance d_1 and with mass at the farthest distance d_2 are measured.
- Hence the moment of inertia and rigidity modulus of the wire are calculated using the given formula.

Moment of inertia of the disc $I = \dfrac{2m(d_2^2 - d_1^2)}{T_2^2 - T_1^2} T_0^2$ kg m^2

Rigidity Modulus $\eta = \dfrac{8\pi I \times l}{T_o^2 r^4}$ Nm^{-2}

EXPLANATION OF SYMBOLS

m - Mass of one of the symmetrical masses (kg)

d_1 – Closest distance between the axis of the pendulum and the centre of the mass (m)

d_2 – Farthest distance between the axis of the pendulum and the centre of the mass(m)

T_o – Time period of oscillation without mass (sec)

T_1 – Time period of oscillation with mass at a distance d_1 (sec)

T_2 – Time period of oscillation with mass at a distance d_2 (sec)

l - Length of the suspension wire (m)

r – Radius of the wire (m)

CLEANING AND MAINTENANCE

- Clean the all used apparatus after use.
- All the used apparatus are maintained in good condition on a regular basis according to the manufacturer's instruction

PRECAUTIONS TO BE FOLLOWED

- The plane of the circular disc must be horizontal
- The suspension wire should be well clamped, thin, long and free from kinks.
- The motion of the circular disc should be purely torsional rotation in horizontal plane. Up and down and lateral oscillations must be completely removed.
- The radius of the wire and the period of oscillations should be measured accurately since they occur in fourth and second power in the formula respectively.

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF PHYSICS
PHYSICAL SCIENCES (PHYSICS) LAB

Name of the Lab/ Facility	**Engineering Physics Laboratory**
Name of the Experiment	**AIR WEDGE**
Purpose	To find the thickness of the thin wire using Air-wedge experiment.
Scope	This SOP describes how to determine the thickness of the wire using Air-wedge experiment. Thickness of the wire and thin maternal need to be determined accurately using Travelling Microscope.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE

- Before start, clean and arrange the required apparatus such as Travelling microscope, Na vapour lamp, optical glass plates, reading lens and thin wire.
- Ensure the presence of proper electrical connectivity.
- Air wedge set up consists of two plane optical glass plates, one end tied with rubber band and in another end a thin wire is inserted whose thickness is to be measured, experimental set up are arranged as shown in fig.
- Light from the source is made passing parallel on it.
- The parallel beam is incident on glass plate at 45^{o} and gets reflected towards air-wedge set up
- By adjusting Air wedge set up, focusing of travelling microscope, the interference fringes are viewed through traveling microscope.
- The vertical cross wire of the microscope is adjusted using horizontal fine adjustment screw to coincide with any one of the dark fringes, taken as n, the reading is noted from the horizontal scale.
- The microscope is moved either left or right using fine- adjustment screw of horizontal scale and

made to coincide with every successive 5th fringe. The readings are noted. The distance l, between the wire and one edge of contact is measured with the help of travelling microscope.

- From the observed readings, the thickness of the given wire can be calculated by using the given formula.

Thickness of thin wire $t = \frac{\lambda l}{2\beta}$ m

EXPLANATION OF SYMBOLS

λ – Wavelength of Na vapour lamp (5893 X 10^{-10} m) (m)

l- Distance between the wire and the edge of the contact (m)

β –Band width (m)

CLEANING AND MAINTENANCE

- Clean the all used apparatus after use.
- Travelling Microscope and Na source are maintained in good condition on a regular basis according to the manufacturer's instruction

PRECAUTIONS TO BE FOLLOWED:

- Careful handling is required while use the glass plates and light source.
- The two glass plates must be cleaned and should be optically plane.
- The quality of light should be adjusted for maximum visibility.
- The movement of the vernier should be in one direction only so as to avoid back-lash error

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF PHYSICS
PHYSICAL SCIENCES (PHYSICS) LAB

Name of the Lab/ Facility	**Engineering Physics Laboratory**
Name of the Experiment	**SPECTROMETER-GRATING**
Purpose	To determine the wavelength of the predominant spectral lines of Mercury source.
Scope	This SOP describes how to determine the wavelength of the predominant spectral lines of Mercury source using Spectrometer. Finding the wavelength of the spectral lines need to ensure and compare the measured wavelength with standard wavelength of the spectrum.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE

- Before start, clean, and arrange the required apparatus such as Spectrometer, Mercury Source, Spirit level, grating.
- Ensure the presence of proper electrical connectivity.

INITIAL ADJUSTMENT OF SPECTROMETER

- The initial adjustment of the spectrometer are made
- The grating is placed on the grating table
- The slit is illuminated by source of light
- The telescope is brought in line with the collimator and the direct ray is made coincide with vertical cross wire and the reading is fixed as 0^o and 180^o by adjusting vernier scale on either side.

ADJUSTMENT OF THE GRATING FOR NORMAL COINCIDENCE

- The telescope is rotated by an angle 90^o (either left or right) and fixed.
- The grating table is rotated until the reflected image of slit is coincided with vertical cross wire. The vernier table is released and rotated by an angle 45^o towards the collimator.
- Now light coming out from the collimator will be incident normally on the grating.
- Hg vapour lamp is used for normal incidence adjustment.
- The central direct ray is viewed.
- The telescope is moved on either side of the direct image, the diffraction patterns of the

spectra of 1st and 2nd order are seen

- The readings are taken (Vernier A and Vernier B) by coinciding each colour with vertical cross wire and are tabulated
- The angles of diffraction for different colours are determined and the wavelengths are calculated using the given formula.

Wavelength of the spectral lines in Hg spectrum

$$\lambda = \frac{\text{Sin } \theta}{\text{Nm}}$$

The number of lines per meter in grating is

$$N = \frac{\text{Sin } \theta}{m\lambda} \qquad (\text{where}, \lambda = 5461\text{Å})$$

Where

λ – Wavelength of the spectral lines (m)

N- Number of lines in grating (lines/m)

m- Order of spectral lines

CLEANING AND MAINTENANCE

- Clean the all used apparatus after use.
- Spectrometer and light sources are maintained in good condition on a regular basis according to the manufacturer's instruction

PRECAUTIONS TO BE FOLLOWED:

- Careful handling is required while use Grating and light sources.
- All the initial adjustments should be followed.

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF PHYSICS
PHYSICAL SCIENCES (PHYSICS) LAB

Name of the Lab/ Facility	**Engineering Physics Laboratory**
Name of the Experiment	**THERMAL CONDUCTIVITY OF BAD CONDUCTOR- LEE'S DISC METHOD**
Purpose	To determine the thermal conductivity of bad conductor using Lee's disc apparatus.
Scope	This SOP describes how to determine thermal conductivity of bad conductor using Lee's disc apparatus. Determination of thermal conductivity of bad conductor is essential to know the thermal behaviour of the materials.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE

- Before start, clean, and arrange the required apparatus such as Lee's disc apparatus, bad conductor (mica/glass/cardboard), thermometers, stop clock, steam boiler, screw gauge, vernier caliper, rubber tubes, and beakers.
- Ensure the presence of proper electrical connectivity.
- Set up the Lee's disc arrangement.
- Bad conductor (mica/glass/cardboard), whose thermal conductivity is to be measured, is placed between the steam chamber and the metallic disc.
- Thermometers are inserted in to the holes provided in the chamber and the disc.
- Steam boiler is heated and steam passed through the chamber until the steady state temperatures are reached in the chamber and disc.
- The steady state temperature of the chamber (θ_1) and the steady state temperature of the metallic disc (θ_2) are noted. From the thermometer.
- Now the bad conductor is removed so that temperature increases quickly because of direct

contact. When the temperature raises 10° C above θ_2 value, the chamber is removed and the metallic disc is allowed to cool.

- Start the stop clock when the temperature reaches (θ_2 + 5)° C and the time is noted for every 1° C fall of temperature until the disc attains (θ_2 - 5)° C.
- A graph is drawn between the temperature along X-axis and time along Y- axis; rate of cooling at θ_2 is calculated from the slope of the graph.
- Thickness, radius of the metallic disc are measured and tabulated.
- Thickness of the cardboard is measured and tabulated and hence thermal conductivity of the bad conductor can be calculated using the below formula.

Thermal Conductivity of the bad conductor

$$K = \frac{Msd(r+2h)}{\pi r^2(2r+2h)(\theta_1-\theta_2)}\left(\frac{d\theta}{dt}\right)_{\theta_2} \quad W\ m^{-1}\ K^{-1}$$

EXPLANATION OF SYMBOLS

M – Mass of the metallic disc (kg)

S – Specific heat capacity of the material of the disc J/kg/K

$\left(\frac{d\theta}{dt}\right)_{\theta_2}$ - Rate of cooling at steady state temperature θ_2 (° C)

θ_1 - Steady state temperature of steam chamber (° C)

θ_2 - Steady state temperature of metallic disc (° C)

r – Radius of the metallic disc (m)

h – Thickness of the metallic disc (m)

d – Thickness of the bad conductor (m)

CLEANING AND MAINTENANCE

- Clean the all used apparatus after use.
- Used apparatus are maintained in good condition on a regular basis according to the manufacturer's instruction

PRECAUTIONS TO BE FOLLOWED:

- Careful handling is required while use the Heater and Thermometers.
- The bad conductor used should be perfectly dry.
- Bad conductor should be kept well pressed in between the steam chamber and the base-plate.
- Steady state temperature θ_2 should be noted only when it is maintained for nearly 10 minutes.
- The gradient at θ_2 should be found accurately.
- When the rate of cooling is monitored, the condition should be identical with the first part. The experiment should not be conducted near an open window or any place where wind may blow.

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF PHYSICS
PHYSICAL SCIENCES (PHYSICS) LAB

Name of the Lab/ Facility	**Engineering Physics Laboratory**
Name of the Experiment	**COEFFICIENT OF VISCOSITY OF THE LIQUID-POISEULLE'S METHOD**
Purpose	To determine the co-efficient of viscosity of the given liquid by Poiseulle's method.
Scope	This SOP explains how to determine the co-efficient of viscosity of the given liquid by Poiseulle's method. Co-efficient of viscosity is essential to know the flow nature of the given liquid.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE

- Before start, clean, and arrange the required apparatus such as Graduated burette, Capillary tube, Stop clock, Travelling microscope and Meter scale.
- .A clean and dry graduated burette is clamped vertically and connected to the capillary tube (which is kept horizontally) by means of a rubber tube.
- The burette is then filled with water above 0 Cc level without any air bubble sticking to its sides.
- The burette knob is opened so that the liquid flows through the horizontal capillary tube in stream lined motion.
- When the level of the liquid in the burette comes to 0cc, a stop-clock is started and when the level of the liquid reaches 5, 10,15,
- 20…..45cc, note the time without stopping the stop-clock.
- h_1, h_2, h_o are measured.
- Hence the pressure head is calculated using given formula.
- The radius of the bore of the capillary tube is measured using travelling microscope.
- Co-efficient of viscosity of the given liquid can be calculated from the following formula

Coefficient of viscosity $\eta = \frac{\pi \rho g r^4 h t}{8 l V}$ Nsm^{-2}

Pressure head $h = \frac{h_1 + h_2}{2} - h_0$ m

EXPLANATION OF SYMBOLS:

ρ- Density of liquid (kg/m^3)

g – Acceleration due to gravity (m/s^2)

r – Radius of the capillary tube (m)

l – Length of the capillary tube (m)

h_1 – Height of the initial level of the liquid from table (m)

h_2 – Height of the final level of the liquid from table (m)

h_o – Height from table to axis of the capillary tube (m)

t – Time taken for the flow of 5 cc liquid (m)

V – Volume of the liquid (m^3)

CLEANING AND MAINTENANCE

- Clean the all used apparatus after use.
- Used apparatus and Travelling Microscope are maintained in good condition on a regular basis according to the manufacturer's instruction

PRECAUTIONS TO BE FOLLOWED:

- Careful handling is required while use the Burette and Capillary tube**.**
- The capillary tube should be cleaned well.
- The liquid taken for study should be free from any contamination in the form of precipitates, dirt, etc.
- The diameter of the bore should be accurate.
- The capillary tube should be horizontal.
- Flow of liquid should be steady and slow, that is streamline flow should be maintained.

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF PHYSICS
PHYSICAL SCIENCES (PHYSICS) LAB

Name of the Lab/ Facility	**Engineering Physics Laboratory**
Name of the Experiment	**PARTICLE SIZE DETERMINATION - LASER DIFFRACTION METHOD**
Purpose	To determine the size of the lycopodium particle using laser source.
Scope	This SOP explains how to determine the size of the lycopodium powder using laser source through diffraction method. Determining the size of the unknown powder is ensuring the size of the powder whether in micro or nano size. Student can visualize the diffraction pattern of the laser light and understand the uses of the semiconductor laser.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE

- Before start, clean, and arrange the required apparatus such as laser source, Screen, Scale, Glass plate containing lycopodium powder.
- Ensure the presence of proper electrical connectivity.
- Insert the Lycopodium sprinkled glass plate in between the screen and the source.
- The laser beam is allowed to fall on the glass plate.
- Then, glass plate is moved back and forth until the clear image of the spectrum is seen.
- The distance between the screen and the glass plate is noted
- Due to diffraction, the circular fringes are obtained. The radii of fringes are noted.
- The values X_1, X_2, X_3 are belonging to first order, second order, third order respectively.
- The above procedure is repeated thrice and tabulate, and size of the powder can be determined by the following formula

The size of the particle d = $\frac{\lambda m\sqrt{X_m^2 + D^2}}{X_m}$ m

EXPLANATION OF SYMBOLS:

λ - Wavelength of laser source (6700 X 10^{-10} m)

m – Order of the fringes

X_m – Radius of the circular fringes (m)

D – Distance between the particle slit and screen (m)

CLEANING AND MAINTENANCE

- Clean the all used apparatus after use.
- Used Laser Source and Grating are maintained in good condition on a regular basis according to the manufacturer's instruction

PRECAUTIONS TO BE FOLLOWED:

- Careful handling is required while use the Laser Source, Glass Plate and Grating**.**
- Direct contact of eyes with laser beam should be avoided.

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF PHYSICS
PHYSICAL SCIENCES (PHYSICS) LAB

Name of the Lab/ Facility	**Engineering Physics Laboratory**
Name of the Experiment	**ULTRASONIC INTERFEROMETER**
Purpose	To determine the Ultrasonic velocity and compressibility of the given liquid.
Scope	This SOP explains how to determine the Ultrasonic velocity and compressibility of the given liquid using Ultrasonic Interferrometer. Determining the Ultrasonic velocity and compressibility of the given liquid is used to know the flow nature of the liquid.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE

- Before start, clean, and arrange the required apparatus such as Ultrasonic interferometer, given liquid, beaker.
- Ensure the presence of proper electrical connectivity.
- Principle is Acoustic grating
- Given liquid is filled in the ultrasonic liquid cell.
- High frequency generator is used to produce ultrasound.
- Quartz crystal which is in basement of the instrument produces stationary standing wave pattern because of superposition of incident and reflected waves from the reflector.
- Readings are noted down using micrometer screw, fixed at the top of the liquid cell.
- For every node, the deflections at the frequency generator are observed.
- For consecutive three deflection cycle(each cycle consists of one maximum and minimum), the readings are noted.

- Ultrasonic velocity and compressibility of the given liquid can be calculated using the following formulae

Ultrasonic wavelength λ = 2d/N (m)

Ultrasonic velocity V $= \lambda \times f$ (ms^{-1})

Adiabatic compressibility $\beta = \frac{1}{V^2 \rho}$ (m^2N^{-1})

EXPLANATION OF SYMBOLS:

d = Distance between maxima (m)

N=1

ρ = Density of liquid (kgm^{-3})

f = frequency of the Ultrasonic generator (Hz)

CLEANING AND MAINTENANCE

- Clean the all used apparatus after use.
- Used Ultrasonic interferometer is maintained in good condition on a regular basis according to the manufacturer's instruction.

PRECAUTIONS TO BE FOLLOWED:

- Careful handling is required while use the Ultrasonic interferometer and Beaker.
- Do not switch on the generator without filling the experimental liquid in the cell.
- Remove experimental liquid out of the cell after use, keep it clean and dry.
- While cleaning the cell, it should be noted that the gold plating on the crystal is not spoiled or scratched.

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF PHYSICS
PHYSICAL SCIENCES (PHYSICS) LAB

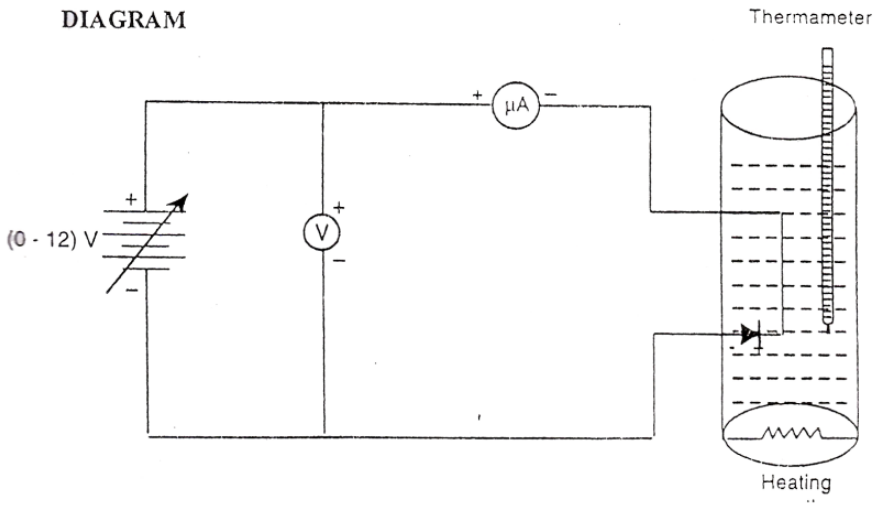
Name of the Lab/ Facility	**Engineering Physics Laboratory**
Name of the Experiment	**BAND GAP ENERGY OF SEMICONDUCTOR**
Purpose	To determine the width if the forbidden energy gap in a semiconductor material taken in the form of p-n junction diode.
Scope	This SOP explains how to determine the width if the forbidden energy gap in a semiconductor material taken in the form of p-n junction diode. Determining the energy gap is used to know the electrical behaviour of the material.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE

- Before start, clean, and arrange the required apparatus such as 0-15V dc power supply, heating arrangement to heat the diode, thermometer,0-50 μA micro ammeter, germanium/silicon diode (or) Band gap determination kit.
- Ensure the presence of proper electrical connectivity.
- Sufficiently long wires are soldered to the diode terminals and the diode is connected to the circuit as shown in figure. The diode is immersed in an oil bath that in turn kept in a heating mantle. A thermometer is also kept in the oil bath such that its mercury bulb is just at the height of the diode.
- The power supply is switched on and the voltage is adjusted to say 5 volts. The current through the diode and the room temperature are noted.

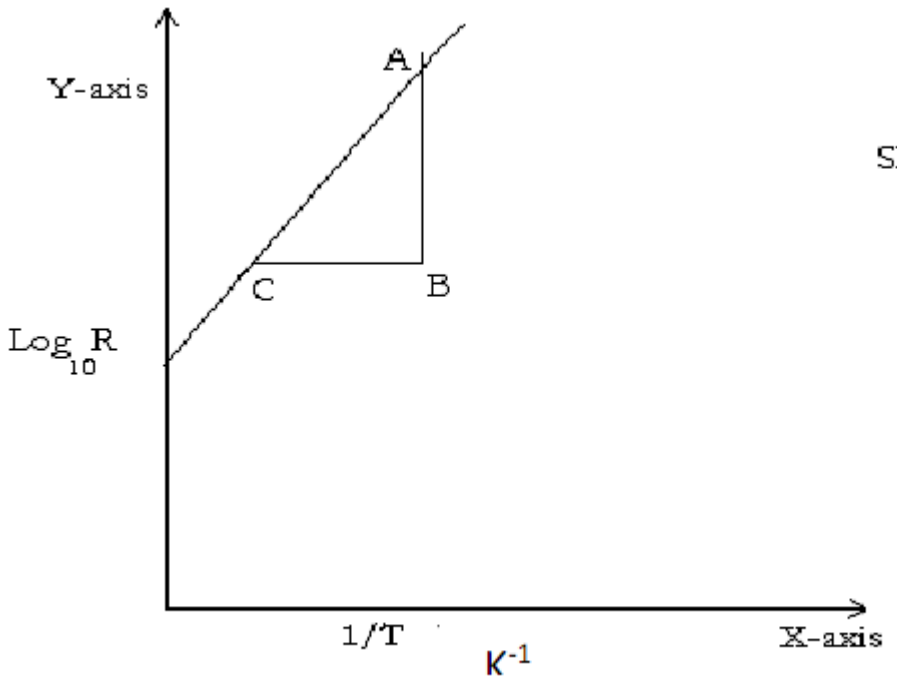
- The power supply is switched off. The heating mantle is switched on and the oil bath is heated and stirred so that temperature of oil bath is stabilized say at 75°C.
- The power supply is again switched on and the voltage is kept at 5V. The temperature says 75°C and the corresponding current through the diode are noted.

DIAGRAM



Energy gap of semiconductor material can be determined by the following formula

Band gap energy E_g= 0.198 X Slope (eV)



$$\text{Slope} = \frac{AB}{BC}$$

CLEANING AND MAINTENANCE

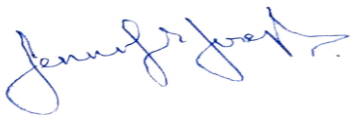
- Clean the all used apparatus after use.
- Used apparatus and components are maintained in good condition on a regular basis according to the manufacturer's instruction.

PRECAUTIONS TO BE FOLLOWED

- Careful handling is required while performing experiment.

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record



HOD – H & S

DEPARTMENT OF PHYSICS
PHYSICAL SCIENCES (PHYSICS) LAB

Name of the Lab/ Facility	**Engineering Physics Laboratory**
Name of the Experiment	**POTENTIOMETER**
Purpose	To find the resistance of the wire.
Scope	This SOP explains the how to determine the resistance of the wire using Potentiometer. Determining resistance of the wire is useful to understand electrical behaviour of the material.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE

- Before start, clean, and arrange the required apparatus such as A ten meter Potentiometer wire, Resistance box, Accumulator, Daniel cell, Key, Galvanometer, High resistance, Jockey, Connecting Wires.
- Ensure the presence of proper electrical connectivity.
- Primary circuit is made by connecting "A" end of the potentiometer with resistance, positive end of the Accumulator and key to "B" end as shown in fig.
- Secondary circuit is made by connecting the resistance to Daniel cell's positive end, Galvanometer, High resistance to Jockey. This is including resistance Circuit
- By sweeping Jockey on the potentiometer wire, the galvanometer shows null value at one point. This balancing length (l_1) is measured for the values of resistance ie., 1, 2,…..10 ohms
- Now the secondary circuit is modified by excluding resistance, by means of connecting directly Daniel cell to "A" end as shown in figure.
- By sweeping Jockey on the potentiometer wire, the galvanometer shows null value at one point. This balancing length (l_2) is measured for the values of resistance ie., 1, 2,…..10 ohms

- The resistance of the potentiometer wire is calculated.

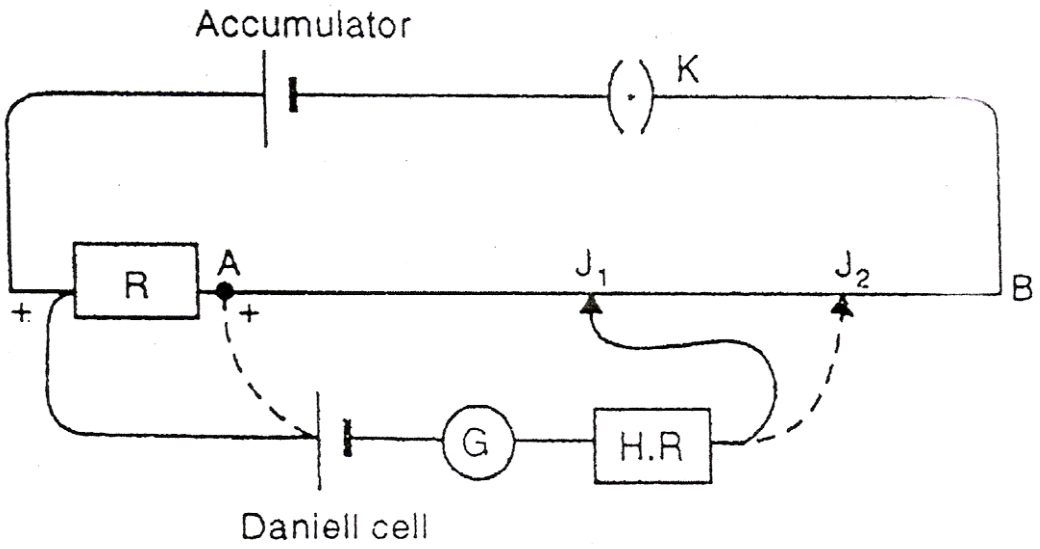
The resistance of potentiometer wire (R_P) = $\frac{R \times 10}{l_1 - l_2}$ ohm

EXPLANATION OF SYMBOLS

R – Resistance in the resistance box (ohm)

l_1 – Balancing length including resistance (m)

l_2 – Balancing length excluding resistance (m)



CLEANING AND MAINTENANCE

- Clean the all used apparatus after use.
- Used Potentiometer and other components are maintained in good condition on a regular basis according to the manufacturer's instruction.

PRECAUTIONS TO BE FOLLOWED

- Care should be taken while handling the electricity.
- The potentiometer wire should be uniform.
- The resistance of the potentiometer wire should be high.

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF CHEMISTRY
PHYSICAL SCIENCES LAB – CHEMISTRY

STANDARD OPERATING PROCEDURE FOR UV- VISIBLE SPECTROPHOTOMETER

Name of the Lab/ Facility	Engineering Chemistry Laboratory
Purpose	To describe the procedure for the operation and maintenance of the UV- Visible Spectrophotometer.
Scope	This instrument is used to measure how much light of a given wavelength is absorbed by the liquid sample.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE FOR
UV- VISIBLE SPECTROPHOTOMETER

- Open panel door and make sure cuvette holders are empty, and then close the panel door.
- Flip open the display unit and turn Spectrophotometer ON by flipping the yellow switch on the side of the machine. The machine will automatically initialize.
- Hold the cuvette from the top to prevent tampering with the measurements, and wipe the sides with a lab tissue.
- Open panel door and place the cuvette with blank solution in the cuvette holders. When the Auto Zero is complete, open the panel door and remove the front cuvette.
- Do not replace cuvette in rear holder.
- Using the same cuvette style, fill an empty cuvette with about 2 ml of the sample.
- Clean the cuvette with a lab tissue.
- Place in front cuvette holder, using the appropriate orientation and close the panel door.
- Press START to take a reading.
- To turn of the machine after completion of the experiment.

PRECAUTIONS TO BE FOLLOWED **N/A**

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF CHEMISTRY
PHYSICAL SCIENCES LAB – CHEMISTRY

STANDARD OPERATING PROCEDURE pH METER

Name of the Lab/ Facility	Engineering Chemistry Laboratory
Purpose	To describe the procedure for the operation and maintenance of the pH meter.
Scope	This SOP describes how to use and maintain a pH meter. The pH is intended for accurate measurement of the pH of buffer solution used in the chemistry laboratory.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE FOR pH METER

- Before use, rinse the electrode with deionised water and blot dry with a soft, lab tissue.
- Transfer the electrode to the test solution.
- Compensate for the temperature if necessary.
- Record the pH when the reading is staple (5-20 seconds) after insertion of the electrode into the solution.
- Rinse the electrode with the deionised water and store according to the manufacturer's instruction.

Cleaning and maintenance

- Clean the pH meter with s sort, clean, damp paper towel after use. No solvent should be used.
- Replace the electrode filled in solution on a regular basis according to the manufacturer's instruction

PRECAUTIONS TO BE FOLLOWED N/A

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

HOD – H & S

DEPARTMENT OF CHEMISTRY
PHYSICAL SCIENCES LAB – CHEMISTRY
STANDARD OPERATING PROCEDURE FOR CONDUCTIVITY METER

Name of the Lab/ Facility	Engineering Chemistry Laboratory
Purpose	To describe the procedure for the operation and maintenance of the Conductivity Meter.
Scope	This SOP provides the laboratory person with guidance on the procedure for determining conductivity on liquid and water sample.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE FOR CONDUCTIVITY METER.

- Turn on the conductivity meter.
- Rinse the electrode with the deionised water.
- Set the room temperature and adjust calibration control to get 1000 display on the READOUT.
- Select the appropriate conductance range and cell constant in the conductivity meter with the help of deionised water.
- Stir the probe gently in the sample to create a homogenous sample, allowing a few seconds for the temperature reading to approach the solution temperature.
- Take reading.
- Rinse the electrode with the deionised water and store according to the manufacturer's instruction.

Cleaning and maintenance

- Immerse the electrode of the cell in dilute potassium dichromate in 6N Sulphuric acid for one day. Rinse in running water followed by distilled water.
- Conductivity cell should always be kept dipped in distilled water for atleast 2 hours before use.

PRECAUTIONS TO BE FOLLOWED N/A

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

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HOD – H & S

DEPARTMENT OF CHEMISTRY
PHYSICAL SCIENCES LAB – CHEMISTRY

STANDARD OPERATING PROCEDURE FOR POTENTIOMETER

Name of the Lab/ Facility	**Engineering Chemistry Laboratory**
Purpose	To describe the procedure for the operation and maintenance of the Potentiometer.
Scope	This SOP provides the laboratory person with guidance on the procedure for determining EMF of the solution.
Responsibility	It is the responsibility of the Lab Incharge of the Lab to train Lab Assistant and students on this procedure and to ensure adherence to this procedure. It is the responsibility of the students / Technician to follow the SOP as describe and to inform the Lab Incharge about any deviation or problems that may occur while performing the procedure.

STANDARD OPERATING PROCEDURE FOR CONDUCTIVITY METER.

- Turn on the Potentiometer and allow warming up for about a minute.
- Two channels are provided for doing two set of experiments. There is a channel selector switch to set CH-A or CH- B to which the electrodes are connected.
- Turn the button to READOUT to start the experiment.
- The display will indicate the reading corresponding to the channel. The display should read 1018 (mV).
- Rinse the electrode with the deionised water. The Reference electrode connected to negative terminal and metallic electrode to the positive terminals.
- The solution is to be stirred with the glass rod till the readings are stable .
- Take reading.
- Rinse the electrode with the deionised water and store according to the manufacturer's instruction.

Cleaning and maintenance

- Clean the electrodes with deionised water and clean with tissue paper.
- Replace the electrode filled in solution on a regular basis according to the manufacturer's instruction.

PRECAUTIONS TO BE FOLLOWED N/A

RECORD TO BE MAINTAINED

- Laboratory manual containing the experiment that can be performed with the equipment.
- Maintenance record

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