Certificate Course FY

Basic Instrument Handling in Physics Laboratory

Number of Students:-27

20 July 2019 To 31 August 2019

"Permission Letter"

Date:12/07/2019

To,

The Principal,

Nutan Mahavidyalaya, Selu

Subject: Request for permission to organize a Certificate Course in "Basic Instrument Handling in Physics Laboratory "

Sir

I, Dr. B.K.Kumthekar , Head of the Department of Physics, request you to kindly grant me permission to organize a Certificate Course in for the academic year **2019-20**. The course will be conducted from 20 July 2019 To 31 August 2019

The following are the details of the course:

Course Name:- **Basic Instrument Handling in Physics Laboratory**

Duration: 5 Weeks

Dates: 20 July 2019 To 31 August 2019

The course will be conducted by experienced faculty members from the Department of Physics of the college. The course will be beneficial for students who are interested in pursuing a career in Basic Science

I will be grateful if you permit me for the same

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NUTAN MAHAVIDYALAYA,SELU,DIST.PARBHANI

Certificate Course In Physics

Academic Year-2019-20

NOTICE

All students of B.Sc.First Year Physics are hereby informed that a certificate course on "**Basic Instrument Handling in Physics Laboratory** "is scheduled from 20 July 2019 To 31 August 2019 .Interested Students should register their name to Dr.B.K.Kumthekar before 16/07/2019

The Course mentioned above is scheduled as follows,

Date	Time	Course	Faculty	Room No.
20/07/2019 To 31/08/2019	2:00 to 2:50	Calculations in Physics Using Log Table	Dr.B.K.Kumthekar Mr.V.P.Patil Mr.B.P.Kshirsagar	Physics Lab

Course Co-ordinator

Dr.B.K.Kumthekar

Principal

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Department Of Physics

Inaugral Function Of

Certificate Course On "Basic Instrument Handling in Physics Laboratory "

Academic Year-2019-20

Date:- 20/07/2019

Introduction And Welcome	Dr.B.K.Kumthekar (Head Department Of Physics)
Introduction Of the Guest	Mr.V.P.Patil
Chief Guest	**Dr.V.K.Kothekar** (Deputy Secretary Of Nutan Vidyalaya Shikshan Sanstha's)
President Of Programme	**Dr.S.S.Kulkarni** (Principal, Nutan Mahavidyalaya,Selu)
Anchoring	More Vaishnavi Rustumrao
Vote Of Thanks	Kalbande Nikita Chandrakant
Venue	**Department Of Physics**
Time	2:00 pm

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Timetable:-

Sr. No	Date		Time	Teacher's Name	Topic
1	20/07/2019	Saturday	2:00 to 2:50	Dr.B.K.Kumthekar	Overview of common instruments used in physics labs
2	22/07/2019	Monday	2:00 to 2:50	Mr.V.P.Patil	Importance of instrument handling and safety precautions
3	23/07/2019	Tuesday	2:00 to 2:50	Mr.B.P.Kshirsagar	Introduction to measurement units and systems
4	24/07/2019	Wednesday	2:00 to 2:50	Dr.B.K.Kumthekar	Precision vs. accuracy in measurements
5	25/07/2019	Thursday	2:00 to 2:50	Mr.V.P.Patil	Understanding instrument calibration procedures
6	26/07/2019	Friday	2:00 to 2:50	Mr.B.P.Kshirsagar	Introduction to optical instruments like microscopes and telescopes
7	29/07/2019	Monday	2:00 to 2:50	Dr.B.K.Kumthekar	Introduction to thermometers and temperature sensors
8	30/07/2019	Tuesday	2:00 to 2:50	Mr.V.P.Patil	Basics of spectroscopic techniques
9	31/07/2019	Wednesday	2:00 to 2:50	Mr.B.P.Kshirsagar	Handling spectrometers
10	01/08/2019	Thursday	2:00 to 2:50	Dr.B.K.Kumthekar	Basics of soldering and circuit assembly
11	02/08/2019	Friday	2:00 to 2:50	Mr.V.P.Patil	Safety precautions while working with electronics
12	05/08/2019	Monday	2:00 to 2:50	Mr.B.P.Kshirsagar	Common problems encountered with laboratory instruments
13	06/08/2019	Tuesday	2:00 to 2:50	Dr.B.K.Kumthekar	Techniques for diagnosing and resolving issues of laboratory instruments
14	07/08/2019	Wednesday	2:00 to 2:50	Mr.V.P.Patil	Importance of regular maintenance
15	08/08/2019	Thursday	2:00 to 2:50	Mr.B.P.Kshirsagar	Cleaning techniques for various instruments
16	09/08/2019	Friday	2:00 to 2:50	Dr.B.K.Kumthekar	Basics:Least Count Of Measuring Instruments
17	12/08/2019	Monday	2:00 to 2:50	Mr.V.P.Patil	Use of Vernier Caliper
18	13/08/2019	Tuesday	2:00 to	Mr.B.P.Kshirsagar	Use of Micrometer Screw

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			2:50		Gauge
19	14/08/2019	Wednesday	2:00 to 2:50	Dr.B.K.Kumthekar	Hands On Practice with use in Physics Practical
20	16/08/2019	Friday	2:00 to 2:50	Mr.V.P.Patil	Working of Voltmeter
21	19/08/2019	Monday	2:00 to 2:50	Mr.B.P.Kshirsagar	Working of Ammeter
22	20/08/2019	Tuesday	2:00 to 2:50	Dr.B.K.Kumthekar	Hands on Practice
23	21/08/2019	Wednesday	2:00 to 2:50	Mr.V.P.Patil	Colour Code Method of Measuring Resistance
24	22/08/2019	Thursday	2:00 to 2:50	Mr.B.P.Kshirsagar	Introduction Of Travelling Microscope
25	23/08/2019	Friday	2:00 to 2:50	Dr.B.K.Kumthekar	Measurment with travelling Microscope
26	24/08/2019	Saturday	2:00 to 2:50	Mr.V.P.Patil	How to remove error in measuring instruments
27	26/08/2019	Monday	2:00 to 2:50	Mr.B.P.Kshirsagar	Working Of Photo Cell
28	27/08/2019	Tuesday	2:00 to 2:50	Dr.B.K.Kumthekar	Types Thermistors with Practical
29	28/08/2019	Wednesday	2:00 to 2:50	Mr.V.P.Patil	Recap of key concepts covered in previous lectures
30	29/08/2019	Thursday	2:00 to 2:50	Mr.B.P.Kshirsagar	Hands-on practice with various instruments

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NUTAN MAHAVIDYALAYA SELU

Students Participated :-

Sr.No.	Student Name	signature
1	Khandare Pallavi Hanumant	
2	Dagdu Arthavi Vijay	
3	Dagdu Sapna Bhagwan	
4	Ganjare Vaishnavi Gajanan	
5	Markad Ayodhya Arjun	
6	Kalbande Nikita Chandrakant	
7	Sagde Priyanka Pandurang	
8	Kawhale Komal Diliprao	
9	Thorat Prakash Gajendra	
10	Katare Akshay Dattarao	
11	Ghondage Narayan Janardhan	
12	Harkal Disha Dnyanoba	
13	Adhe Sachin Kabirdas	
14	Solanke Radha Dajiba	
15	Babde Prerna H	
16	Shinde Nikita Bhagirath	
17	Musale Nikita Madhavrao	
18	Jadhav Divya Paraji	
19	Shaikh Massarat Jahan	
20	Paikrao Maharani T	
21	Goundage Rutuja Satish	
22	Ghodke Priyanka Rajendra	
23	Kale Karuna Dnayneshwar	
24	More Vaishnavi Rustumrao	
25	Gondhalkar Manjusha Dnayneshwar	
26	More Kajal Ganeshrao	
27	Lagad Vidhya Kishan	

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Attendance Of Students:-

Sr. No	Student Name	20/7/19	22/7/19	23/7/19	24/7/19	25/7/19	26/7/19	29/7/19	30/7/19
1	Khandare Pallavi Hanumant	P	P	P	P	P	P	A	P
2	Dagdu Arthavi Vijay	P	P	P	A	P	P	P	P
3	Dagdu Sapna Bhagwan	P	P	P	P	P	P	P	P
4	Ganjare Vaishnavi Gajanan	P	P	A	P	P	P	P	P
5	Markad Ayodhya Arjun	P	P	P	P	P	P	A	P
6	Kalbande Nikita Chandrakant	P	A	P	P	P	P	P	P
7	Sagde Priyanka Pandurang	P	P	P	P	P	P	P	P
8	Kawhale Komal Diliprao	P	P	P	P	A	P	P	P
9	Thorat Prakash Gajendra	P	P	P	P	P	P	P	A
10	Katare Akshay Dattarao	P	P	P	P	P	P	P	P
11	Ghondage Narayan Janardhan	P	P	A	P	P	P	P	P
12	Harkal Disha Dnyanoba	P	P	P	P	P	P	A	P
13	Adhe Sachin Kabirdas	P	P	P	P	P	P	P	P
14	Solanke Radha Dajiba	P	P	P	P	P	P	P	P
15	Babde Prerna H	P	P	P	P	P	P	P	P
16	Shinde Nikita Bhagirath	P	P	P	A	P	P	P	A
17	Musale Nikita Madhavrao	P	P	P	P	P	P	P	P
18	Jadhav Divya Paraji	P	P	P	P	P	P	P	A
19	Shaikh Massarat Jahan	P	P	P	P	P	P	P	P
20	Paikrao Maharani T	P	P	A	P	P	P	P	P
21	Goundage Rutuja Satish	P	P	P	P	P	P	P	P
22	Ghodke Priyanka Rajendra	P	P	P	P	P	P	P	A
23	Kale Karuna	P	P	P	P	P	P	P	

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	Dnayneshwar								
24	More Vaishnavi Rustumrao	P	P	P	P	P	P	A	P
25	Gondhalkar Manjusha Dnayneshwar	P	P	P	P	P	P	P	P
26	More Kajal Ganeshrao	P	P	P	P	A	P	P	P
27	Lagad Vidhya Kishan	P	P	P	A	P	P	P	A

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Attendance Of Students:-

Sr. No	Student Name	31/7/19	01/8/19	02/8/19	05/8/19	06/8/19	07/8/19	08/8/19	09/8/19
1	Khandare Pallavi Hanumant	P	P	P	P	P	P	P	P
2	Dagdu Arthavi Vijay	P	P	P	P	P	P	P	A
3	Dagdu Sapna Bhagwan	P	P	P	P	P	P	P	P
4	Ganjare Vaishnavi Gajanan	P	P	A	P	P	P	P	P
5	Markad Ayodhya Arjun	P	P	P	P	P	P	A	P
6	Kalbande Nikita Chandrakant	P	P	P	P	P	P	P	P
7	Sagde Priyanka Pandurang	P	P	P	P	A	P	P	P
8	Kawhale Komal Diliprao	P	P	P	P	P	P	P	P
9	Thorat Prakash Gajendra	P	P	P	P	P	P	P	P
10	Katare Akshay Dattarao	P	P	P	P	P	P	P	P
11	Ghondage Narayan Janardhan	P	A	P	P	P	P	P	P
12	Harkal Disha Dnyanoba	P	P	P	P	P	P	P	P
13	Adhe Sachin Kabirdas	P	P	P	P	P	P	A	P
14	Solanke Radha Dajiba	P	P	P	P	P	P	P	P
15	Babde Prerna H	P	P	P	P	P	P	P	P
16	Shinde Nikita Bhagirath	P	P	P	P	P	P	P	P
17	Musale Nikita Madhavrao	P	P	P	P	P	P	P	A
18	Jadhav Divya Paraji	P	P	P	A	P	P	P	P
19	Shaikh Massarat Jahan	P	P	P	P	P	P	P	P
20	Paikrao Maharani T	P	P	P	P	P	P	P	P
21	Goundage Rutuja Satish	P	P	P	P	P	P	P	P
22	Ghodke Priyanka Rajendra	P	P	P	P	P	A	P	P
23	Kale Karuna	P	P	P	P	P	P	P	P

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24	More Vaishnavi Rustumrao	P	P	P	P	A	P	P	P
25	Gondhalkar Manjusha Dnayneshwar	P	A	P	P	P	P	P	P
26	More Kajal Ganeshrao	P	P	P	P	A	P	P	P
27	Lagad Vidhya Kishan	P	P	P	P	P	P	P	A

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Attendance Of Students:-

Sr. No	Student Name	12/8/19	13/8/19	14/8/19	16/8/19	19/8/19	20/8/19	21/8/19	22/8/19
1	Khandare Pallavi Hanumant	P	P	P	P	P	P	P	P
2	Dagdu Arthavi Vijay	P	P	P	P	P	P	P	P
3	Dagdu Sapna Bhagwan	P	P	P	P	P	P	P	A
4	Ganjare Vaishnavi Gajanan	P	P	A	P	P	P	P	P
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7	Sagde Priyanka Pandurang	P	P	P	A	P	P	P	P
8	Kawhale Komal Diliprao	P	P	P	P	P	P	P	P
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13	Adhe Sachin Kabirdas	P	P	P	A	P	P	P	P
14	Solanke Radha Dajiba	P	P	P	P	P	P	P	P
15	Babde Prerna H	P	P	P	P	P	P	A	P
16	Shinde Nikita Bhagirath	P	P	P	P	P	A	P	P
17	Musale Nikita Madhavrao	P	P	P	P	P	P	P	P
18	Jadhav Divya Paraji	P	P	P	P	P	P	P	P
19	Shaikh Massarat Jahan	P	P	A	P	P	P	A	P
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23	Kale Karuna	P	P	P	P	P	P	A	P

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26	More Kajal Ganeshrao	P	A	P	P	P	P	P	P
27	Lagad Vidhya Kishan	P	P	P	P	P	P	P	A

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Attendance Of Students:-

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3	Dagdu Sapna Bhagwan	P	P	P	P	P	P	P
4	Ganjare Vaishnavi Gajanan	P	P	P	P	P	A	P
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9	Thorat Prakash Gajendra	P	P	P	P	P	P	P
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17	Musale Nikita Madhavrao	P	P	P	P	P	P	P
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19	Shaikh Massarat Jahan	P	P	P	P	P	P	P
20	Paikrao Maharani T	P	A	P	P	P	P	P
21	Goundage Rutuja Satish	P	P	P	P	A	P	P
22	Ghodke Priyanka Rajendra	P	P	P	P	P	A	A
23	Kale Karuna	P	P	P	P	P	P	P

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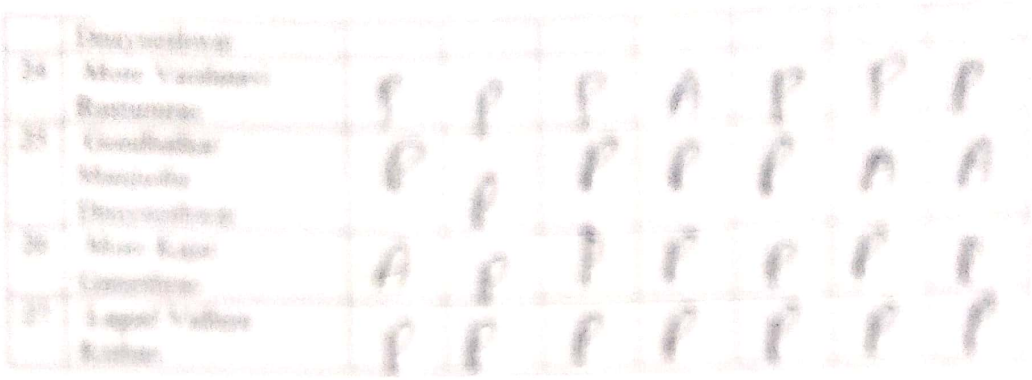

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Introduction :-

This course structure aims to gradually introduce students to various physics instruments, ensuring a hands-on approach and practical application of theoretical knowledge.

Week 1: Introduction to Laboratory Safety and Etiquette

Overview of laboratory safety protocols

Introduction to common laboratory equipment

Importance of proper attire and personal protective equipment

Week 2: Familiarization with Basic Physics Instruments

Understanding and handling rulers, vernier calipers, and micrometers

Introduction to measuring length, diameter, and thickness

Week 3: Exploration of Optical Instruments

Introduction to microscopes and telescopes

Principles of using lenses and mirrors

Hands-on experience with optical instruments

Week 4: Understanding Electrical Instruments

Basics of multimeters and oscilloscopes

Safe handling of electrical components

Introduction to circuit building and analysis

Week 5: Practical Applications and Experiments

Conducting basic physics experiments using learned instruments

Data recording and analysis

Troubleshooting common issues in the laboratory

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"Understanding and handling rulers, vernier calipers, and micrometers - Introduction to measuring length, diameter, and thickness":

1. Rulers:

Basic measuring tool for length.

Commonly marked in centimeters and millimeters.

Use the smallest unit for precise measurements.

2. Vernier Calipers:

Precise measuring instrument for length and diameter.

Consists of a main scale and a sliding vernier scale for accuracy.

Readings include both main scale and vernier scale values.

3. Micrometers:

Highly accurate for measuring small lengths and thickness.

Operates using a spindle and a thimble for fine adjustments.

Readings typically include main scale and thimble values.

Measuring Length:

For rulers, align the object with the zero mark and read the measurement.

In vernier calipers, use both the main scale and vernier scale readings.

In micrometers, measure by closing the jaws gently around the object.

Measuring Diameter:

Vernier calipers can be used to measure the diameter of cylindrical objects.

Place the object between the jaws and use both scales for accurate readings.

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Measuring Thickness:

Micrometers are ideal for measuring thickness.

Close the micrometer gently on the object to get an accurate thickness reading.

Tips for Precision:

Ensure instruments are clean and properly calibrated.

Take multiple readings and calculate an average for accuracy.

Practice using the instruments to enhance proficiency.

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Use of micrometer screw Guge

Aim : To determine the diameter of a given wire & a rod using a micrometer screw gauge.

Apparatus : Micrometer screw gauge, rod, wire, etc.

Observations:

1) Smallest division on main scale = $= 5 = \frac{0.1}{} \text{ cm}$

2) Number of rotations of screw to move it through this smallest division = $n = \frac{1}{}$

3) pitch of the screw $= P = \frac{5}{n} = \frac{0.1}{} \text{ cm}$

4) Total number of division on circular scale $= N = \frac{100}{}$

5) Least count of screw gauge $= LC = \frac{P}{N} =$ $\frac{0.001}{} \text{ cm}$

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Result:

1) Diameter of a wire = 0.423 cm.
2) Radius of a wire = 0.212 cm

3) Diameter of a rod = 0.489 cm.
4) Radius of a rod = 0.245 cm

Observation table:

Sr no	M.S.R (a)	C.S.R (b)	Total Reading a+(bx(c)	Mean Reading
1)	0.0 cm	45	0.045 cm	
2)	0.0 cm	42	0.042 cm	0.0423 cm
3)	0.0 cm	40	0.040 cm	

Calculations:

1) Mean diameter of a wire = D = 0.0423 cm

2) Radius of a wire = $R = \frac{D}{2} = \frac{0.0423}{2} = 0.02115$

$= 0.0212$

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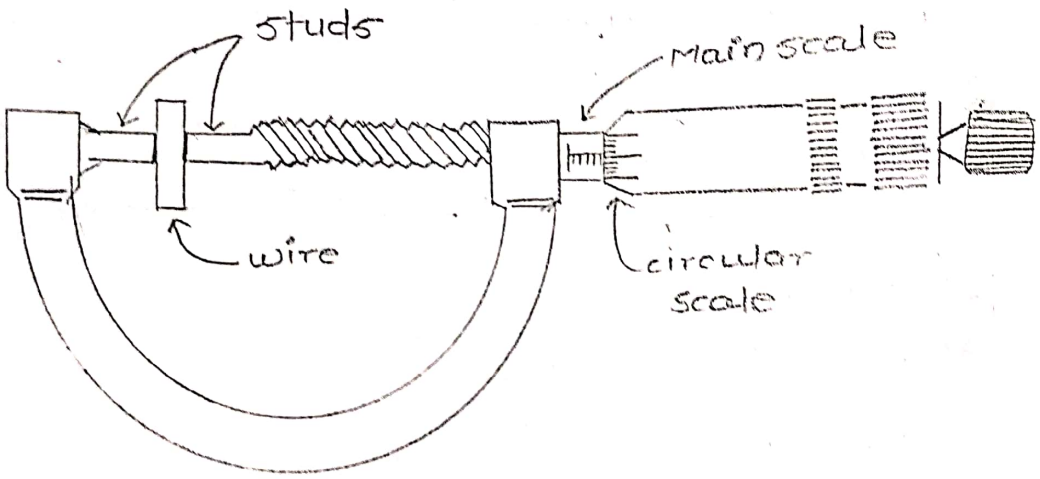
Figure :



observation table:

SE NO	M.S.R (a)	C.S.R (b)	Total Reading. a+(bxLC)	Mean Reading
1)	0.4cm	89	0.489 cm	
2)	0.4cm	90	0.490 cm	0.489cm
3)	0.4cm	88	0.488 cm	

Calculations:

1) Mean diameter of a rod = b = 0.489 cm

2) Radius of a rod = $\frac{D}{2}$ = 0.245

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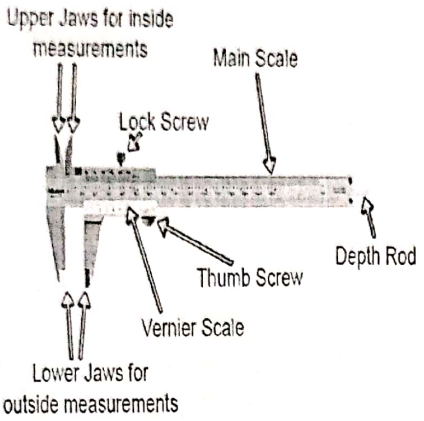
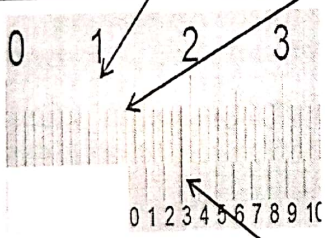
How to use Vernier Calipers



1. Unlock the lock screw and press the thumb screw down. Open the jaws.
2. Close the jaws around the object you want to measure or, for inside measurements open them until the fill the gap you wish to measure, or insert the depth rod into the hole you wish to measure.
3. Tighten the lock screw so that the jaws do not move.
4. Now read the scale.

a. Read off the centimetre mark to the left of the vernier scale zero. In this case 1 cm.

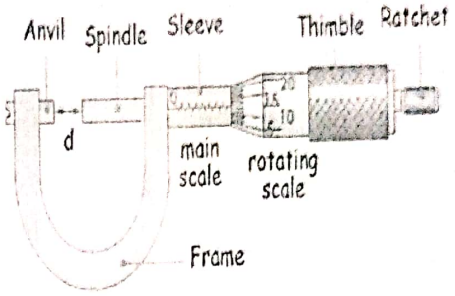
b. Read off the millimetre mark to the left of the vernier scale zero. In this case 3 mm.



d. Add the readings together to get your measurement.
1cm + 3 mm + 0.3 mm = 13.3 mm
or 1.33 cm

c. Look along the vernier scale to find the point where the line matches up with the line on the bar scale. This tells you the number of tenths of a millimetre, in this case 0.3 mm.

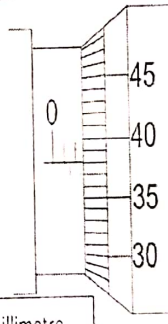
How to use a Micrometer Screw Gauge



1. Open the micrometer by turning the thimble or ratchet.
2. Place the object to be measured between the spindle and anvil.
3. Close the spindle by turning the ratchet, not the thimble. The ratchet prevents excess pressure on the object being measured, so you don't squash it and get a false reading.
4. Now read the scale.

a. Read off the millimetre mark to the left of the thimble.

c. Read off the hundredths of a millimetre where the scale on the thimble meets the centre of the main scale. In this case 0.38 mm.



b. Is there a half millimetre mark before the millimetre mark to the left of the thimble? If there is add 0.5 mm to your mm reading. So in this case 2.5 mm

d. Add the readings together so the thickness measured here is:
2.5 + 0.38 = 2.88 mm.

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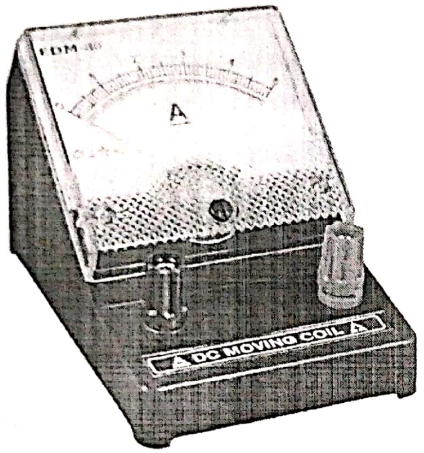
An ammeter is a device used to measure the amount of current in an electric circuit. The device can measure both alternating current as well as direct current. The device measures the current in the units of Ampere.



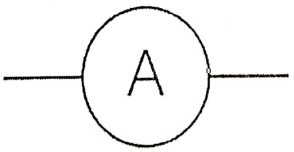
What is an Ammeter?

Ammeters are calibrated and modified galvanometers, since like the galvanometers they too measure the current by deflections of the magnetic coil. But, unlike the galvanometers, they are calibrated and do not show the direction of the current.

To effectively measure the current flowing through the circuit the ammeter must allow the current to easily flow through it. Thus the ideal ammeter has an internal resistance of zero. The resistance of an ammeter should be necessarily zero as ammeters are connected in series in the circuit and ammeters with resistance would just increase the total resistance in the circuit. Though the internal resistance of an ammeter is zero, there is always resistance of the coil which is accounted for during extending the range of the ammeter.

Ammeters have varying ranges. They may generally have 50 divisions upon which current ranging from 0-5A, 0-50mA, etc. can be measured.

Ammeter Symbol



The ammeter is represented by the symbol:

Parts of an Ammeter

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An ammeter is constructed using different parts as shown in the image above. The general construction of an ammeter includes

- U-shaped magnet – The magnet serves as a major component in an ammeter. It consists of concave poles.
- Copper coil – The copper coil is generally rectangular and is wound around a metallic core.
- Iron Core – The copper coil is wound around a soft iron core. Due to the presence of the soft iron cylindrical core, the magnetic field between the poles increases and the field lines remain parallel.
- Shunt – It is a low-value resistance connected in parallel to the galvanometer.
- Pointer – The pointer which is attached to the coil in a pivoting manner to read the deflection.

Working of Ammeter

When an ammeter is connected in series in a circuit, the current flowing through the ammeter is equal to the current flowing through the circuit. Due to this current, there are deflections in the magnetic coils of the ammeter which moves the pointer across the graduated scale. This results in the measurement of the load current.

The ammeter's working principle is the same as the working of the galvanometer. A galvanometer can also be modified into an ammeter by connecting a shunt resistance in parallel to the galvanometer, which would increase the range of measurement of current.

Types of Ammeter

The different types of ammeter are as follows:

- Permanent Magnet Moving Coil Ammeter – The ammeter coil is kept in between poles of a permanent magnet. Depending upon the magnitude of the current, the deflection of the coil occurs, which is translated into the movement of the pointer on the calibrated scale. It is used for measuring DC.
- Moving Iron Ammeter – These types of ammeters are used for measuring AC as well as DC. It consists of two small pieces of soft iron. One of them is attached to the coil and the other is attached to the pointer. When the soft iron attached to the coil becomes magnetized it causes either attraction or repulsion of the other piece of soft iron which then rotates proportionally.
- Electrodynamometer type Ammeter – These types of ammeters are very accurate and are used to measure both AC and DC. Unlike other types, it consists of two coils and is transfer-type equipment.
- Rectifier type Ammeter – This type of ammeter is used to find only alternating current magnitude in the circuit. These types of ammeters use diodes in rectifier arrangement along with a magnetic coil.

Difference Between Ammeter and Voltmeter

The differences between ammeter and voltmeter has been discussed below.

Ammeter	Voltmeter

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This device is used to measure current in a circuit.	This device is used to measure the voltage across two points in a circuit.
The internal resistance of an ammeter is low.	The internal resistance is high for a voltmeter.
To measure the total current in the circuit the ammeter is connected in series to a circuit.	The voltmeter is connected in parallel across the components where the potential difference is to be measured.

What Is a Voltmeter?

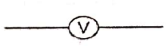
A voltmeter, also known as a voltage meter, is an instrument that measures the voltage or potential difference between two points of an electronic or electrical circuit. Usually, the voltmeter is used for Alternating Current (AC) circuits or Direct Current (DC) circuits. Alternatively, Radio Frequency (RF) voltage can also be measured by specialised voltmeters.

A voltmeter measures voltages usually calibrated in volts, millivolts (0.001 volt), or kilovolts (1,000 volts). In order to measure a device's voltage, a voltmeter is connected in parallel to a device. This setup is important as objects in parallel usually tend to experience the same potential difference. It is connected in parallel with the circuit, mainly because the same voltage drop occurs across it.

A voltmeter also has high internal resistance. This is done mainly because it is used in measuring the potential difference between the two points of the circuit. As such, the current of the measuring device remains the same. In other words, the high resistance of the voltmeter will impede the flow of current through it. This allows the device to take correct readings of the voltage.

Voltmeter Symbol

The voltmeter is usually represented by the letter V, which is placed inside a circle adjoining two



terminals.

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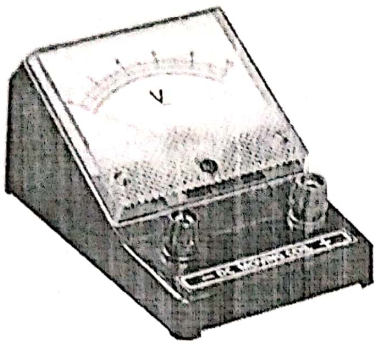

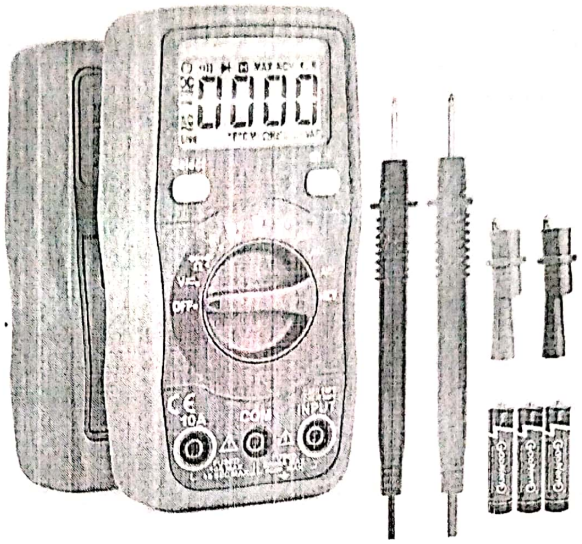

Types of Voltmeter

Today, a lot of the voltmeters are digital, which gives the readings as numerical displays. However, analogue forms are also available, and this type of voltmeter gives readings wherein a pointer starts moving in some direction, indicating voltage on a scale. Digital voltmeters are preferred because they generally have a higher order of accuracy than analogue voltmeters. We will discuss them in detail below.

Analogue or Analog Voltmeter

An analogue voltmeter is used mainly for measuring the AC voltage. The reading is displayed with the help of a pointer that is fixed on the calibrated scale. The movement of the pointer is affected by the torque that is acting on it. The magnitude of the torque that is developed is directly proportional to the voltage being measured.

A galvanometer (current meter) that is sensitive and is part of a high resistance series is what makes a basic analogue voltmeter. The meter should have high internal resistance, or else the circuit operation during the test would be interrupted by drawing current significantly. The voltage range displayed by the meter is determined by the series resistance value and the galvanometer sensitivity.

On the other hand, to measure low voltages, an oscilloscope is often used where instantaneous voltage is depicted by the vertical displacement. RF and AC applications have their peak-to-peak and peak voltage measured by the oscilloscopes. Wiring, insulators and heavy-duty probes are crucial for making the meters for measuring high potential differences.

Digital Voltmeter

Another voltmeter that is quite often used among voltage measurement instruments is the digital voltmeter. A digital voltmeter (DVM) measures an unknown input voltage by converting the voltage to a digital value, and then displays the voltage in numeric form. DVMs are usually designed around a special type of analogue-to-digital converter called an integrating converter.

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There are different factors that have an impact on the accuracy of the DVM, like input impedance, temperature, and power supply voltage variations of the DVM. Around 10 MΩ is the input resistance of DVMs that are the least expensive. The input resistances for precision DVMs of 1 GΩ or higher for ranges of low voltages (below 20 V). The DVM must be periodically calibrated with a voltage standard, like the Weston Cell, as a way to ensure the manufacturer's specified tolerances.

Other Types of Voltmeter

These are voltmeters based on their construction.

- MI Voltmeter: Moving Iron (MI) voltmeter is a device that is used for measuring both AC and DC voltages. In this device, the deflection is directly proportional to the voltage of the coil. It is further divided into two types – Attraction Type Moving Iron Instruments and Repulsion Type Moving Iron Instruments.
- Rectifier Voltmeter: These are widely used in AC circuits for measuring voltage. This voltmeter converts the AC into DC with the help of a rectifier. The converted DC signal is then measured using the PMMC instrument.
- PMMC Voltmeter: A Permanent Magnet Moving Coil (PMMC) voltmeter, also known as a D'Arsonval meter or simply galvanometer, measures the current in a coil by observing the coil's angular deflection in a uniform magnetic field. The current is induced in the PMMC instrument due to the measure and voltage, and deflection of the pointer occurs. The PMMC voltmeter is used for DC measurement.
- Electro-dynamometer Voltmeter: This voltmeter is used to measure the voltage of both AC and DC circuits. The calibration is usually kept the same for both the AC and DC measurement.
- Amplified Voltmeter: These are voltmeters whose sensitivity and input resistance can be increased or decreased. This can be done if the current required to deflect the meter pointer is supplied by an amplifier and power supply.

As described above, voltmeters are made in different styles. Moreover, some portable ones are separately powered with the help of a battery, whereas others are powered by the measured voltage source. In any case, these are usually designed to measure current or resistance and are often used as standard test instruments in electrical work environments.

Reference Books :-

1. Physics Lab Experiments by, Matthew French
2. Optics and Optical Instrument, An Introduction, By B. K. Johnson
3. PHYSICS I: EXPERIMENTS By, Erhan Gülmez & Zuhal Kaplan

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Basic Instrument Handling in Physics Laboratory

Q.Solve the following multiple choice questions.

1)What is the correct way to read the measurement on a vernier caliper?

A) Directly from the main scale

B) Directly from the vernier scale

C) By adding the main scale reading and the vernier scale reading

D) By subtracting the main scale reading from the vernier scale reading

2)Which instrument is commonly used to measure small electrical currents?

A) Ammeter

B) Voltmeter

C) Galvanometer

D) Ohmmeter

3)How should a thermometer be held to obtain an accurate reading?

A) Tilted slightly upwards

B) Tilted slightly downwards

C) Held perpendicular to the line of sight

D) Held parallel to the line of sight

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4)What should be adjusted to achieve proper focus when using a microscope?

A) Condenser

B) Objective lens

C) Eyepiece

D) Stage

5)In a physics laboratory, what instrument is used to measure atmospheric pressure?

A) Barometer

B) Manometer

C) Thermometer

D) Anemometer

6)Which tool is commonly used to measure the length of an irregularly shaped object?

A) Ruler

B) Vernier caliper

C) Micrometer screw gauge

D) Measuring tape

7)What should be ensured before using a voltmeter to measure voltage?

A) It should be set to the highest voltage range

B) It should be set to the lowest voltage range

C) It should be connected in series with the circuit

D) It should be connected in parallel with the circuit

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8)How is the zero error of a measuring instrument corrected?

A) By adding it to the measurement

B) By subtracting it from the measurement

C) By ignoring it

D) By resetting the instrument

9)Which of the following is not a safety precaution when handling laboratory instruments?

A) Wearing safety goggles

B) Wearing gloves

C) Keeping the workspace tidy

D) Rushing through experiments

10)What is the purpose of a spectrophotometer in a physics laboratory?

A) To measure the intensity of light

B) To measure the speed of light

C) To measure the wavelength of light

D) To measure the temperature of light

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Q.Solve the following multiple choice questions.

1)Which of the following instruments is commonly used to measure mass in a physics laboratory?

A) Voltmeter

B) Ammeter

C) Thermometer

D) Balance

2)What instrument is typically used to measure the length of an object in a physics laboratory?

A) Ruler

B) Thermometer

C) Barometer

D) Stopwatch

3)Which instrument is used to measure the temperature of an object in a physics laboratory?

A) Barometer

B) Voltmeter

C) Thermometer

D) Hygrometer

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4)Which of the following instruments is used to measure electric current?

A) Ammeter

B) Voltmeter

C) Barometer

D) Thermometer

5)In a physics laboratory, what instrument is commonly used to measure time intervals?

A) Voltmeter

B) Ruler

C) Stopwatch

D) Balance

6)What instrument is used to measure the pressure of gases or liquids in a physics laboratory?

A) Barometer

B) Thermometer

C) Hygrometer

D) Manometer

7)Which instrument is used to measure the potential difference between two points in an electric circuit?

A) Ammeter

B) Voltmeter

C) Barometer

D) Thermometer

8)In a physics laboratory, what instrument is used to measure the acceleration due to gravity?

A) Thermometer

B) Ruler

C) Stopwatch

D) Gravitometer

9)What instrument is commonly used to measure the frequency of a periodic signal in a physics laboratory?

A) Ammeter

B) Voltmeter

C) Tachometer

D) Thermometer

10)Which instrument is used to measure the humidity of the air in a physics laboratory?

A) Barometer

B) Thermometer

C) Hygrometer

D) Manometer

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Nutan Mahavidyalaya, Selu

Principal

PRINCIPAL
Nutan Mahavidyalaya
SELU. Dist. Parbhani

NUTAN MAHAVIDYALAYA SELU

CERTIFICATE

OF COMPLETION

This is to be certified that

Ms. Jadhav Divya P.

has successfully completed certificate course entitled as Basic Instruments Handling conducted by Department of PHYSICS from 24/7/19 to 31/8/19 with O/A/B/C/D grade.

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

Coordinator certificate course

Co-Ordinator
Nutan Mahavidyalaya,Selu(MS)

IQAC

Director
IQAC
Nutan Mahavidyalaya, Selu

Principal

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

NUTAN MAHAVIDYALAYA SELU

CERTIFICATE

OF COMPLETION

This is to be certified that

Ms. Khandare Pallavi H.

has successfully completed certificate course entitled as Basic Instruments Handling conducted by Department of PHYSICS from 20/7/19 to 31/8/19 with O/A/B/C/D grade.

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

Coordinator certificate course

Co-Ordinator
Nutan Mahavidyalaya,Selu(MS)

IQAC

Director
IQAC
Nutan Mahavidyalaya, Selu

Principal

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

NUTAN MAHAVIDYALAYA SELU

CERTIFICATE

OF COMPLETION

This is to be certified that

Ms. Dagdu Asthavi V.

has successfully completed certificate course entitled as Basic Instruments Handling ....conducted by Department of PHYSICS ....from 20/3/19 to 31/8/19 with O/A/B/C/D grade.

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

Coordinator certificate course

Co-Ordinator
Nutan Mahavidyalaya,Selu(MS)

IQAC

Director
IQAC
Nutan Mahavidyalaya, Selu

Principal

PRINCIPAL
Nutan Mahavidyalaya
SELU. Dist. Parbhani

NUTAN MAHAVIDYALAYA SELU

CERTIFICATE

OF COMPLETION

This is to be certified that

Ms. Dagdu Sapna B.

has successfully completed certificate course entitled as Basic Instruments Handling conducted by Department of PHYSICS from 20/7/19 to 31/8/19 with O/A/B/C/D grade.

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

Coordinator certificate course

Co-Ordinator
Nutan Mahavidyalaya,Selu(MS)

IQAC

Director
IQAC
Nutan Mahavidyalaya, Selu

Principal

PRINCIPAL
Nutan Mahavidyalaya
SELU. Dist. Parbhani

NUTAN MAHAVIDYALAYA SELU

CERTIFICATE

OF COMPLETION

This is to be certified that

Ms. Ganjare Vaishnavi G.

has successfully completed certificate course entitled as Basic Instruments Handling conducted by Department of PHYSICS from 20/7/19 to 31/8/19 with O/A/B/C/D grade.

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

Coordinator certificate course
Co-Ordinator
Nutan Mahavidyalaya, Selu(MS)

IQAC
Director
IQAC
Nutan Mahavidyalaya, Selu

Principal
PRINCIPAL
Nutan Mahavidyalaya
SELU. Dist. Parbhani

NUTAN MAHAVIDYALAYA SELU

CERTIFICATE

OF COMPLETION

This is to be certified that

Ms. Markad Ayodhya A.

has successfully completed certificate course entitled as Basic Instruments Handling conducted by Department of PHYSICS from 29/7/19 to 31/8/19 with O/A/B/C/D grade.

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

Coordinator certificate course
Co-Ordinator
Nutan Mahavidyalaya, Selu(MS)

IQAC

Director
IQAC
Nutan Mahavidyalaya, Selu

Principal

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

NUTAN MAHAVIDYALAYA SELU

CERTIFICATE

OF COMPLETION

This is to be certified that

Ms. Kalbande Nikita C.

has successfully completed certificate course entitled as

~~Basic Instruments Handling~~ conducted by Department

of PHYSICS from 2019 to 2019 with O/A/B/C/D grade.

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

Coordinator certificate course

Co-Ordinator
Nutan Mahavidyalaya Selu(MS)

IQAC

Director
IQAC
Nutan Mahavidyalaya, Selu

Principal

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

NUTAN MAHAVIDYALAYA SELU

CERTIFICATE

OF COMPLETION

This is to be certified that

Ms. Sagde Priyanka P.

has successfully completed certificate course entitled as Basic Instruments Handling conducted by Department of PHYSICS from 20/8/19 to 31/8/19 with O/A/B/C/D grade.

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

Coordinator certificate course
Co-Ordinator
Nutan Mahavidyalaya,Selu(MS)

IQAC
Director
IQAC
Nutan Mahavidyalaya, Selu

Principal
PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

NUTAN MAHAVIDYALAYA SELU

CERTIFICATE

OF COMPLETION

This is to be certified that

Ms. Kawbase Komal D.

has successfully completed certificate course entitled as Basic Instruments Handling conducted by Department of PHYSICS from 20/1/19 to 31/8/19 with O/A/B/C/D grade.

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

Coordinator certificate course
Co-Ordinator
Nutan Mahavidyalaya,Selu(MS)

IQAC

Director
IQAC
Nutan Mahavidyalaya, Selu

Principal
PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

NUTAN MAHAVIDYALAYA SELU

CERTIFICATE

OF COMPLETION

This is to be certified that

Mr. Thorat Bakash G.

has successfully completed certificate course entitled as Basic Instruments Handling conducted by Department of PHYSICS from 2/3/19 to 31/3/19 with O/A/B/C/D grade.

PRINCIPAL
Nutan Mahavidyalaya
SELU, Dist. Parbhani

Coordinator certificate course

Co-Ordinator
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IQAC

Director
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Nutan Mahavidyalaya, Selu

Principal

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