



**NSAI**

National Metrology Laboratory

# 2018 Programme of Training Courses in Measurement & Calibration

NSAI National Metrology Laboratory offers public courses to help individuals gain the skills that they require in the field of Measurement and Calibration. The courses detailed in this brochure are shown opposite.

Courses are to be held in NML or in-company on request. Additional courses may also be arranged on demand. All the tutors are experts in their field, and have extensive experience in training.

Understanding the principles of Measurement and Calibration can lead to better decisions on product purchasing, reduced need for expensive technical support and reduced operational mistakes with expensive consequences.

Please book online at  
**www.nsai.ie** or return the booking form to:

**NSAI NATIONAL METROLOGY LABORATORY**

**Clare Dunne / Caroline Tyndall**

Course Reservations

Glasnevin, Dublin 11

D11 E527 Ireland

Telephone +353 1 808 2609/2605

Facsimile +353 1 808 2603

Email [nml@nsai.ie](mailto:nml@nsai.ie)

## Keep up with NSAI news

Subscribe to NSAI Ezine

[www.nsai.ie/NSAI-Ezine](http://www.nsai.ie/NSAI-Ezine)

Follow NSAI Tweets

[@NSAI\\_Standards](https://twitter.com/NSAI_Standards)

Watch NSAI Media

[www.youtube.com/user/NSAImedia](http://www.youtube.com/user/NSAImedia)

Read NSAI LinkedIn

[www.linkedin.com/company/national-standards-authority-of-ireland](http://www.linkedin.com/company/national-standards-authority-of-ireland)

**NSAI.ie**



# NSAI

National Metrology Laboratory

Name:

Title:

Company:

Address:

Telephone:

Email:

Course title(s):

Date of Course(s):

Names of attendee(s):

P.O.

Cheque / VISA / LASER (please circle)

Card No:

Expiry Date:

Security No:

Amount:

Signature:

Date:

CANCELLATIONS: Cancellation within 4 weeks of course date will incur a charge of 20% of the course fee.

COURSE DETAILS	PAGE
----------------	------

FOUNDATION COURSE IN MEASUREMENT & CALIBRATION	1
--	---

EVALUATING MEASUREMENT UNCERTAINTY	2
------------------------------------	---

PRACTICAL DIMENSIONAL CALIBRATION	3
-----------------------------------	---

PRACTICAL TEMPERATURE MEASUREMENT & CALIBRATION	4
---	---

WEIGHTS AND BALANCE CALIBRATION	5
---------------------------------	---

ELECTRICAL MEASUREMENT & CALIBRATION	6
--------------------------------------	---

TEMPERATURE / HUMIDITY MAPPING OF ENCLOSURES	7
--	---

TAILORED METROLOGY COURSES	8
----------------------------	---

PRACTICAL HUMIDITY MEASUREMENT & CALIBRATION	13
--	----

EVALUATING MEASUREMENT UNCERTAINTY - INTERMEDIATE LEVEL	14
--	----

PRACTICAL PIPETTE CALIBRATION	15
-------------------------------	----

## **CT001**

### **FOUNDATION COURSE IN MEASUREMENT & CALIBRATION**

**DATES:**

6<sup>th</sup> February 2018

22<sup>nd</sup> May 2018

9<sup>th</sup> October 2018

**DURATION:**

1 day

**VENUE:**

NML or in-company  
by arrangement

**FEE:**

€480 (including  
documentation,

This training course is intended for professionals who are new to the field of calibration or who are responsible for the management and administration of an in-house calibration system.

**COURSE CONTENT**

- Measurement Standards and Traceability
- Measurement Uncertainty
- Test Uncertainty Ratio
- Instrument Accuracy Specification
- Calibration Certificates
- Recalibration Intervals
- Laboratory Accreditation
- Tour of NML facilities

*Tuition will consist of classroom work, exercises and practical demonstrations.*

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.

## CT002

# EVALUATING MEASUREMENT UNCERTAINTY

This training course is intended for professionals who perform or manage critical measurement/calibration tasks and who need to evaluate the measurement uncertainties associated with their measurement results. The course is based on the internationally accepted method given in the Guide to the Expression of Uncertainty in Measurement.

### COURSE CONTENT

- The importance of measurement uncertainty
- Understanding and modelling the measurement process
- Statistical tools for uncertainty evaluation
- Identifying and assessing measurement input quantities
- Using Excel© to formulate an uncertainty budget
- Combining standard uncertainties
- Reporting the measurement uncertainty
- Worked examples and exercises on uncertainty evaluation

*Tuition will consist of classroom work, exercises and practical sessions.*

*Note: Extra half day option available to discuss user specific uncertainty evaluations.  
(price on request)*

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.

### DATES:

19<sup>th</sup> April 2018

### DURATION:

1 day (with an additional half day option available)

### VENUE:

NML or in-company by arrangement

### FEE:

€480 (including documentation, lunch and refreshments)

## CT003

# PRACTICAL DIMENSIONAL CALIBRATION

### DATES:

2<sup>nd</sup> May 2018

2<sup>nd</sup> October 2018

### DURATION:

1 day

### VENUE:

NML or in-company  
by arrangement

### FEE:

€480 (including  
documentation,  
lunch and  
refreshments)

This training course is intended for professionals who make dimensional measurements on components and for people who are responsible for the calibration of dimensional measuring instruments. The emphasis of this training course is on the practical aspects of dimensional measurement and calibration.

This course provides the knowledge and expertise for people who use measurement tools or require an appreciation of the importance of measurement, calibration and the use of dimensional measurement techniques to complete their daily tasks.

### COURSE CONTENT

- Principles of Measurement and Calibration
- Dimensional units, traceability, and standards
- Uncertainty of Measurement
- Specifications and tolerances - interpretation of BS/ISO Specifications
- Usage, storage and handling of dimensional standards and artefacts
- Calibration of calipers, micrometers and dial gauges
- Use of gauge blocks in dimensional calibration
- Recording calibration results and reviewing calibration certificates
- Error avoidance tactics for dimensional measurements

*Tuition will consist of classroom work, exercises and practical demonstrations.*

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.



## CT004

# PRACTICAL TEMPERATURE MEASUREMENT & CALIBRATION

The training course is intended for professionals who are responsible for the calibration of temperature measuring instruments and standards. The emphasis is on the practical aspects of temperature measurement and calibration.

The course provides the knowledge and expertise for those who use temperature measuring devices or require an appreciation of the importance of measurement, calibration and the use of temperature instruments and standards in the performance of their daily tasks.

### COURSE CONTENT

- Principles of Temperature Measurement and Calibration
- Temperature Units, terminology, traceability and standards
- Thermometer Types: Thermocouples, Liquid in Glass thermometers, Platinum Resistance Thermometers and Thermistors
- Accuracy of Thermometers
- Temperature Mediums: Liquid Baths, Dry Blocks, Ovens
- Thermometer usage, selection and application - Sources of errors
- In-house calibration methods i.e. profiles in ovens

*Tuition will consist of classroom work, exercises and practical sessions.*

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.

**DATES:**  
12<sup>th</sup> April 2018

**DURATION:**  
1 day

**VENUE:**  
NML or in-company  
by arrangement

**FEE:**  
€480 (including  
documentation,  
lunch and  
refreshments)

## CT005

### WEIGHTS & BALANCE CALIBRATION

**DATES:**

7<sup>th</sup> March 2018

19<sup>th</sup> September 2018

**DURATION:**

1 day

**VENUE:**

NML or in-company  
by arrangement

**FEE:**

€480 (including  
documentation,  
lunch and  
refreshments)

This training course is intended for those professionals who are responsible for the calibration of weighing machines and the maintenance of associated mass standards. The emphasis of this one day training course is on the practical aspects of mass measurement.

The course is designed to provide participants with an understanding of weighing machines and mass standards and covers topics such as mass classification, mass standards, calibration procedures and environmental influences.

**COURSE CONTENT**

- Review of general calibration principles
- Mass units, traceability, and standards
- Mass classification - construction, material, tolerances
- Mass standards - usage, storage and handling
- Selection of mass standards for in-house balance calibration
- Calibration of weighing machines and balances
- Minimum weight requirements
- Brief introduction to uncertainty of measurement
- Error avoidance tactics for mass measurements

*Tuition will consist of classroom work, exercises and practical demonstrations.*

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.

## **CT006**

# **ELECTRICAL MEASUREMENT & CALIBRATION**

The training course is intended for calibration professionals who are responsible for the calibration of electrical measuring instruments (DC and low frequency). The emphasis is on the practical aspects of electrical calibration.

### **COURSE CONTENT**

- Review of general calibration principles
- Electrical units, traceability, and standards
- Calibration of hand-held digital multimeters
- Calibration of current and voltage sources
- Calibration of decade resistance boxes
- Error avoidance tactics for electrical measurements
- Further topics \*

\*As far as is possible, the course content is tailored to meet the specific needs of participants. This is done by means of a questionnaire which is sent to intending participants prior to the course.

*Tuition will consist of classroom work, exercises and practical sessions.*

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.

### **DATES:**

1<sup>st</sup> November 2018  
On Demand

### **DURATION:**

1 day

### **VENUE:**

NML or in-company  
by arrangement

### **FEE:**

€480 (including  
documentation,  
lunch and  
refreshments)

## CT009

### TEMPERATURE / HUMIDITY MAPPING OF ENCLOSURES

**DATES:**  
16<sup>th</sup> February 2018

**DURATION:**  
1/2 day

**VENUE:**  
NML or in-company  
by arrangement

**FEE:**  
€300 (including  
documentation,  
lunch and  
refreshments)

The training course is intended for professionals involved in using, maintaining and calibrating temperature/ humidity chambers and enclosures and for those with responsibility for managing the enclosure calibration programme.

The emphasis of this course is on the best practice and review of relevant internationally accepted methods for enclosure mapping.

#### COURSE CONTENT

- Overview & introduction
- Temperature Mapping of Enclosures including latest Guidelines and Standards
- A comparison of Enclosure Validation Techniques as described in IEC 60068
- Calibration & mapping Techniques for temperature/ humidity enclosures

*Tuition will consist of classroom work, exercises and practical demonstrations.*

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.

## CT010

### TAILORED METROLOGY COURSES

NML offers the possibility of taking a tailored course containing short training modules on specific topics, at a foundation and intermediate level. Such modules are ideal as refresher courses, for those already working in the field who wish to extend their knowledge to other measurement areas, or for those requiring training on a specific measurement topic.

Intending participants may tailor the course to their requirements by indicating the training modules of interest to them. NML will then arrange the course for a suitable date, normally within one month of the request. Training can be provided at the NML or in-company.

In the latter case, the practically based modules will require access to the company's own laboratories facilities. Participants will receive a documentation pack for each training module. The courses are normally restricted to six persons or less. It is intended to add further modules in the near future.

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.

**DATES:**  
On Demand

**DURATION:**  
1 day

**VENUE:**  
NML or in-company  
by arrangement

**FEE:**  
On Application

# CT010

## TAILORED METROLOGY COURSES

### CONT.

#### FOUNDATION LEVEL

Appropriate for beginners or as a refresher for those working in the field.

MODULE	SUMMARY	DURATION
1	Introduction to the concepts of measurement, measurement uncertainty and test uncertainty ratio	1 hr
2	Calibration and traceability	1 hr
3	Interpreting Instrument Accuracy Specifications	1 hr
4	Calibration Certificates and Re-calibration Intervals	1 hr

## CT010

### TAILORED METROLOGY COURSES CONT.

#### INTERMEDIATE LEVEL – INTRODUCTORY MODULES

Participants should be familiar with the foundation level material. These modules are recommended as an introduction for each measurement field.

MODULE	FIELD	SUMMARY	DURATION
5	Mass	Units, traceability and standards in the field of mass measurement	.5 hr
6	Temp	Units, traceability and temperature scales	1 hr
7	Length	Units, traceability and standards in the field of length measurement	2 hr
8	Elect	Electrical quantities, their ranges, units and traceability	1 hr

## CT010

### TAILORED METROLOGY COURSES CONT.

#### INTERMEDIATE LEVEL – PRACTICAL MODULES

Participants should be familiar with the foundation level material. These modules are practically based modules and include laboratory work.

MODULE	FIELD	SUMMARY	DURATION
9	Mass	Specification, use and care of mass standards (standard weights)	1.5 hr
10	Mass	Calibration of Balances	1.5 hr
11	Temp	Specification, use and calibration of thermocouples	1.5 hr
12	Temp	Specification, use and calibration of Platinum Resistance Thermometers	1.5 hr
13	Temp	Specification, use and calibration of Liquid-in-glass thermometers	1.5 hr
14	Temp	Media for temperature calibration (Liquid baths, Dry Block Calibrators, Ovens)	1.5 hr
15	Length	Calibration of mechanical hand tools (micrometers, vernier callipers, dial gauges)	2 hr
16	Length	Specification, use and calibration of gauge blocks (end standards)	2 hr



## CT010

### TAILORED METROLOGY COURSES CONT.

MODULE	FIELD	SUMMARY	DURATION
17	Elect	Calibration of handheld digital multimeters	1.5 hr
18	Elect	Resistance - the calibration of ohmmeters and decade resistance boxes	1.5 hr
19	Elect	DC voltage and current - the calibration of voltage and current sources	1.5 hr
20	Elect	AC Current and Voltage - definitions, sources and measuring equipment	1.5 hr
21	Elect	Use and calibration of high voltage probes and current clamp meters	1.5 hr
22	Elect / Temp	Calibration of temperature indicators by electrical simulation	1.5 hr

**DATES:**  
On Demand

**DURATION:**  
1 day

**VENUE:**  
NML or in-company  
by arrangement

**FEE:**  
Costs are calculated on an hourly rate. Please contact NML for further details. In the case of in-company training, travel and subsistence costs will also be incurred.

## **CT011**

### **PRACTICAL HUMIDITY MEASUREMENT & CALIBRATION**

**DATES:**

18<sup>th</sup> May 2018  
On Demand

**DURATION:**

1 day

**VENUE:**

NML or in-company  
by arrangement

**FEE:**

€500 (including  
documentation,  
lunch and  
refreshments)

The training course is intended for those who are responsible for the calibration of humidity measuring instruments and standards.

The emphasis is on the practical aspects of humidity measurement and calibration.

The course provides the knowledge and expertise for professionals who use humidity measuring devices or require an appreciation of the importance of measurement, calibration and the use of humidity instruments and standards in the performance of their daily tasks.

#### **COURSE CONTENT**

- Principles of Humidity measurement
- Hygrometric definitions, units, terminology, traceability
- How hygrometers work
- Types of hygrometers used in industry:  
Dew point instruments, Psychrometer, RH Instruments and Salt solutions
- Measurement uncertainty with particular reference to Climatic chambers, rooms
- Practical advice on applications

*Tuition will consist of classroom work, exercises and practical demonstrations.*

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.

## CT012

# EVALUATING MEASUREMENT UNCERTAINTY - INTERMEDIATE LEVEL

This course serves as a follow-on to CT002 “EVALUATING MEASUREMENT UNCERTAINTY”, which introduced the internationally accepted method of evaluating measurement uncertainty contained in the Guide to the Expression of Uncertainty in Measurement (GUM).

It is aimed at those who regularly perform uncertainty analysis and require a more in-depth understanding of the process.

### COURSE CONTENT

- A review of the GUM method of uncertainty evaluation
- Measurement models and measurement equations
- Uncertainty propagation and Sensitivity Coefficients
- Effective degrees of freedom
- Coverage factors and expanded uncertainties
- Correlated input quantities
- Monte Carlo Simulation

*Tuition will consist of classroom work, exercises and practical demonstrations.*

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.

**DATES:**  
29<sup>th</sup> November 2018  
On Demand

**DURATION:**  
1 day

**VENUE:**  
NML or in-company  
by arrangement

**FEE:**  
€480 (including  
documentation,  
lunch and  
refreshments)

## CT014

### PRACTICAL PIPETTE CALIBRATION

**DATES:**

On Demand

**DURATION:**

1/2 day

**VENUE:**

NML or in-company  
by arrangement

**FEE:**

€300 (including  
documentation,  
lunch and  
refreshments)

The training course is intended for those professionals involved in the calibration of manual and automatic pipettes. The emphasis of this training course is on the practical aspects of pipette calibration.

The course is designed to provide participants with an understanding of the techniques, sources or errors and measurement uncertainty in the calibration of pipettes.

**COURSE CONTENT**

- Review of Pipette Operation
- Principles of Pipette Calibration using gravimetric method
- Selection of balance for Pipette Calibration
- Techniques for Calibration of Pipettes
- Error avoidance tactics in Pipette Calibration

*Tuition will consist of classroom work, exercises and practical demonstrations.*

Cancellations within 4 weeks of course date will incur a charge of 20% of the course fee.

