Expression of interest for PMQC students' training and /or placements

Government of India has initiated the "***Skill Development***" programme for the employability of young Indians in the industries and other stakeholders. In view of increasing global competition, many industries are going for ISO certification and implementing quality system. In the same perspective, CSIR-NPL, being '***National Measurement Institute'*** of the country, therefore, has started a '***One-year Certification Course in Precision Measurements and Quality Control (PMQC)***' in the year 2018 under the ***CSIR Integrated Skill Initiative***' programme where the participants are being trained in the area of precision measurements and quality system especially in ISO/IEC 17025.

This course would provide skilled manpower to 'National Accreditation Board for Testing and Calibration Laboratories (NABL)', legal metrology, accredited calibration & testing laboratories and industries. In today's competitive world, in order to maintain the quality of products and reduce the rejection ratio, it is essential that the staff working in quality control must have knowledge on precision measurement and quality system. We have received very good feedback from the employers of last year batch (2017-18) placed in accredited laboratories and industries.

In the last quarter of the PMQC course, the participants are required to undergo the industrial training in accredited calibration & testing laboratories or Indian industries for the partial fulfillment of the course. This will provide a good opportunity to participants of PMQC course to understand the requirement of industries and accredited laboratories while Industry and accredited laboratories may take benefits from energetic and passionate young minds.

The list of PMQC students with their area of interest and syllabus of the PMQC course shall be made available to interested parties

Interested institute / industries / accredited laboratory can email to satish.rfic@gmail.com, singhsp3@nplindia.org and copy to hrd@nplindia.org by 10th July 2019. The interview of the students for the placement may be arranged between 10 to 16 July 2019 or in October after Oct 20.

Brief Syllabus

Basic Metrology, AC/ DC and Microwave Metrology, Time and Frequency, AC Power, Energy, High voltage and High Current, Quality Control and Management, Optical Radiation, Length and Dimension, Temperature, Humidity, Acoustics and Ultrasonic Metrology, Mass, Force and Related Parameters, Pressure, Vacuum and Fluid Flow, Environmental Metrology.

pl contact:

Dr Rina Sharma, Coordinator, PMQC and head HRD at hrd@nplindia.org , +91-11-45609361

Or

Mr. Satish, Co-coordinator, PMQC, +918860564477/ +91-11-45608510 / +91-11-47091176

singhsp3@nplindia.org

Syllabus

One-Year Certification Course in Precision Measurements and Quality Control

(PMQC 2018-19)

- **Basic Metrology**

Introduction to international and national measurement system including standards, accreditation, legal metrology, Introduction to metrology : Definition, types, need of inspection, terminologies, methods of measurement, selection of instruments, measurement errors, units, measurements standards, calibration, statistical concepts in metrology, Basics of evaluation of uncertainty in measurements, Six sigma methods, measurement system analysis

- **AC/ DC and Microwave Metrology**

Introduction to Josephson Voltage Standard and Quantum Hall Resistance, AC & DC, voltage, resistance, current and related measurement techniques, techniques to measure capacitance and inductance, their traceability, reference standards, AC & DC Transfer difference, multi-junction/ single-junction thermal converters, AC/ DC calibrator, measurement methods and calibration techniques to assign AC-DC voltage/current transfer difference to reference standards, digital multimeter and Zener reference voltage calibration, precise voltage ratio measurements, electrical properties of materials (resistivity, conductivity, dielectric constant and loss tangent), Measurement Automation and Control, Microwave measurement techniques and traceability.

- **Time and Frequency, AC Power, Energy, High voltage and High Current,**

Introduction to AC power and energy measurements, measurement standards and techniques, testing and calibration methods of AC power and energy measuring instruments, traceability. Introduction to AC high voltage and high current standards, Power generation, transmission and distribution, instrument transformer, bulk energy metering, capacitance and tandelta measurement, Reference Standards, Various calibration methods, Precautions & safety.

Introduction to Time and Frequency standards, Quartz, Atomic Clocks, Cesium Standard, Rubidium Standard, International Time Scale, Time Dissemination, Time Transfer, Navigation systems, Calibration of Clocks, Time Interval Counters, Hour meters, GPS receivers and Stop watches, traceability, reference standards.

- **Quality Control and Management**

Introduction to quality management, Introduction to proficiency testing and key comparison exercises, Introduction to relevant ISO standards e.g. ISO 9000, ISO 14000, ISO/IEC 17025 and auditing techniques, Techniques for quality control: proficiency testing, inter-laboratory comparisons, retesting, replicate testing, control charts.

- **Optical Radiation**

Basics of Radiometry and Photometry including definitions of various parameters, Primary Standards traceability of Optical Radiation: Cryogenic radiometer and Blackbody source, Realization of Spectral irradiance scale, Realization of SI base unit of luminous intensity, ‘candela’, Measurement techniques for

Illuminance, Illuminance responsivity, Luminous intensity, Luminous flux and Luminance, Correlated Color Temperature (CCT) and Color coordinates, UV Radiometry, IR Radiometry, Photometry of advanced solid state optical devices: Light Emitting Diode (LED), basic principles of Photometry, Radiometry and Colorimetry, traceability, reference standards.

- **Length and Dimension**

Primary standards for length and dimension, Traceability to SI metre, basics of dimension measurements including linear, angle, form and surface finish, limits and tolerances, Sources of uncertainty in dimensional measurements, Introduction to interferometry and optical techniques, Gauges and instruments used in dimension measurements: Gauge block comparator, LMM, profile projector, 3D profiler, roughness and roundness measuring instruments, gauge blocks, ring gauges, plug gauge, Dial Gauge, calliper checkers, Autocollimator and levels etc., Coordinate metrology and CMM, Calibration procedures and evaluation of uncertainty.

- **Temperature, Humidity, Acoustics and Ultrasonics Metrology**

Basic concepts in temperature metrology, Importance of International Temperature Scales, ITS-90,Traceability of temperature measurements, Concept and Realization of Temperature Fixed Points, Traceability of temperature measurements, Calibration and practices in temperature metrology related to SPRT, LIGT, TCs and Pyrometry, Instrumentation, Measurement techniques and procedure for uncertainty evaluation in the Temperature related metrology and Hygrometry. Practical Demonstration & Training on Calibration procedures, calculations, reports etc. for LIG Thermometers, SPRTs, RTDs Thermocouples, Hygrometers and Pyrometers. Estimation & reporting of Uncertainty in the temperature and humidity related metrology. Introduction to acoustic, ultrasonic and vibration, measurement standards and techniques and traceability, testing and calibration methods of acoustic, ultrasonic and vibration measuring instruments, traceability, reference standards.

- **Mass, Force and Related Parameters**

Introduction to Mass, Volume and Density measurements, Realization and dissemination of SI base unit of mass, Traceability of mass, Volume and Density, Various reference standards of mass, Volume and Density, Concepts of true mass and conventional mass, Archimedes principle, Air buoyancy correction, Calibration techniques of weights, weighing balances, volumetric instruments, hydrometers, Density determination of solids and liquids, Computation of uncertainty in measurements of weights, weighing balances, volumetric instruments, hydrometers. Introduction to force, torque and hardness, measurement standards and techniques, Traceability of force and hardness measurements, testing and calibration methods of force, torque and hardness measuring instruments, traceability, reference standards.

- **Pressure, Vacuum and Fluid Flow**

Basics, applications, concepts and technology of pressure and vacuum science and devices, different types of pressure and vacuum measurement devices, measurement procedures, precautions, safety, difference between absolute and differential pressure gauges, calibration, traceability, units of measurements and its inter-conversion, principles of pressure and vacuum measurements, basic of pneumatic and hydraulic pressures, dynamic and static pressure and vacuum principles, hand-on training on primary and secondary standards with hierarchy of standards. Introduction to fluid flow measurements, measurement standards and techniques, traceability of fluid flow measurements, testing and calibration methods of fluid flow measuring

instruments and reference standards. traceability of fluid flow measurements, testing and calibration methods of fluid flow measuring instruments and reference standards.

- **Environmental Metrology**

Basics of Earth's atmosphere (components and processes); Radiation Budget; Climate change; Environmental impacts; Air Quality; Regulated measurements and instruments (legal metrology); Confidence of testing and measurement protocols for certification/standardization/calibration (industrial metrology) including wind tunnel testing, CAAQMS & OCEMS; traceability to the international systems of units (scientific metrology); Introduction to Indian and International environmental laws and policies.