#1 PROFESSIONAL TRAINING

PIONEERS IN ORGANIZED NDT TRAINING IN KERALA

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TRAINING • CERTIFICATION • CONSULTATION

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Training cost is investment,
Brings returns surely.

Please read this brochure and see how we can contribute to your career.

NDT TECHNOLOGY (P) LTD

Above State Bank of Travancore, M.C. Road, Pallom,
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NDTTECH provides a dedicated training in NDT methods listed here. Those who want to learn, grow and make a unique identity in their career will find our courses and equipments the most appropriate. We began these detailed, organized training program in 1998 . We encourage you to visit our facility at Pallom to see the infrastructure for Professional NDT Training. All instruments that are shown in this brochure are the property of NDT TECH.

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Why training?

To perform a work properly and in order to face tough times on the job, you must be adequately prepared.

Inadequately trained people not only produce goods that are low on quality but also on high costs due to rise in scrap and rework. Quality companies would look for quality men and not just anyone with a certificate!

If you continue to invest in honing your skills then you will be able to produce superior quality of services.

Prudent companies do not view training costs as a drain on revenue but regard them as tools that help in generating quality products.

Training could be costly, but the benefits often exceed the costs.

Why ndttech?

Our courses are among the best available in the country. Examinations offered immediately following courses. Most convenient course dates. Courses delivered in English and if needed in the local language, Malayalam.

Large air conditioned & fully equipped laboratory with manual, automated ndt equipments and a large inventory of reference blocks and test specimens for a hands on practical during the course. Courses delivered by ASNT certified Level III professionals only. We train you so well so that you can be the best in the industry. Seats are limited to 12 in the main classroom for close personal interaction with the instructor.

Please see the list of people whom we have trained from 1998 at the resource page at www.ndttech.org. You may talk to them and see how did we train them. You may already know some of those students who are on www.facebook.com/NDTTech We have trained them to a level where now their employers find them really an asset. Their employers tell us that our training is worth indeed! NDTTECH can be your best training partner. We can help you learn and grow. Quality Assured!

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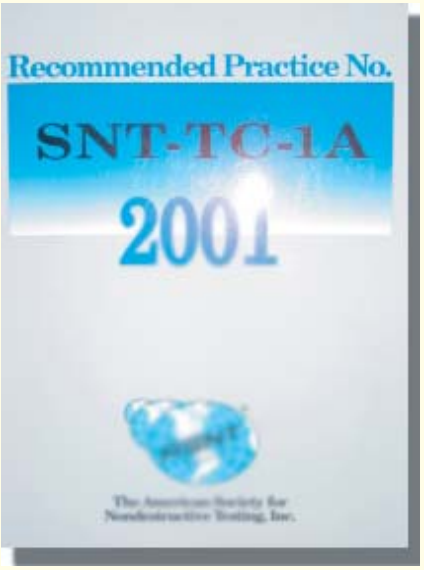
NDT Technology (P) LTD was founded in 1998 with the objective of advancing the science, technology and application of Nondestructive testing and to impart the specialized skills required by the professionals engaged in NDT, Engineering Inspection, Construction and Quality Control.

NDTTECH offers training, consultation, development of automated systems and Inspection services in Nondestructive testing, Engineering Inspection and quality control.

NDTTECH is promoted by the NDT professionals who have been very active in the development of technology, applications and training of professionals in India and abroad.

So far, majority of the NDT professionals in India had been trained on- the-job by their employers, as no organized training facilities were available. NDTTECH is trying to bridge this gap by providing the required training with a combination of classroom training and on-the-job practical.

Courses in NDT currently offered by NDTTECH are formulated based on the requirements of the personnel qualification and certification in Nondestructive testing Recommended Practice No. SNT–TC–1A of The American Society For Nondestructive Testing Inc. (www.asnt.org) For this reason, the qualifications awarded to the successful candidates carry International recognition and acceptance.



FACULTY

The faculty consists of well-qualified and experienced instructors. These instructors have been involved in training and certifying of NDT professionals in India and abroad for several years and possesses quality experience in the world of NDT.

At NDTTECH, all NDT courses are being conducted ONLY by ASNT certified level III, Welding Inspection courses are conducted by the American Welding Society Certified Welding Inspector or CSWIP 3.2 Senior Welding Inspector and ISO 9000 courses are conducted by Certified Lead Assessor.

All our instructors are ASNT certified Level III personnel and have an experience of 20-40 years in Nuclear, Fossil, steel, Oil and Gas industries and would be glad to clarify your work related doubts in the class.

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NDT EQUIPMENT

State of the art NDT instruments, both manual and fully automated systems are available with us for hands on experience. A technical library with a number of books and reference material on NDT and engineering Inspection are provided to assist the students in the acquisition of specific knowledge required.

Custom made software on NDT applications are available with us. NDTTECH has developed several software on NDT automation and is available at class for a hands on trial.

You may download some small sized interactive programs in RT and UT for free at www.ndttechnology.com (www.ndttech.org)

All examination papers are being graded by the relevant NDT level III examiner. NDTTECH has a panel of Level III examiners who have trained and certified many of the older generation NDT professionals.

Nondestructive testing is a career for the high technology age and NDTTECH realizes the responsibility placed on an NDT professional.

NDTTECH is committed to produce the best professionals in NDT. To make this happen, NDTTECH offers post level II courses for those who want to master one or more testing techniques.

Post level II courses are more practical oriented and involves interpretation of the codes and standards in the individual method.

The certifications awarded to the candidates shall provide information on the skill gained by the individual to help find an employment or career growth.

Medium of instruction will be English. Students from other countries should carry good language skills to attend the courses here. Use of advanced translators may be restricted since these often provides more information that can be permitted during an examination.

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Courses offered on a regular basis at our facilities in Kerala. Refer to the schedule for course dates.

RADIOGRAPHIC TESTING (RT)

Radiographic testing involves the use of penetrating X or gamma radiation to examine parts and products for imperfections.

An X-ray machine or radioactive isotope is used as a source of radiation. Radiation is directed through a part and onto the film.
When the film is developed, a shadowgraph is obtained that shows the internal soundness of the part.

Training topics for Level I / II RT.

1.0 Introduction
- 1.1 History and discovery of radioactive materials
- 1.2 Definition of Industrial radiography
- 1.3 Need for radiation protection
- 1.4 Review of school maths
- 1.5 Responsibilities of levels of certification

2.0 Fundamental properties of matter
- 2.1 Elements and atoms
- 2.2 Molecules and compounds
- 2.3 Atomic particles
- 2.4 Atomic structure
- 2.5 Atomic number and weight
- 2.6 Isotope Vs Radioisotope

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3.0 Radioactive materials
- 3.1 Production
- 3.2 Stable Vs Unstable
- 3.3 Curie
- 3.4 Half life of radioactive materials
- 3.5 Plotting of radioactive decay
- 3.6 Specific activity

4.0 Types of radiation
- 4.1 Particulate radiation
- 4.2 Electromagnetic radiation
- 4.3 X ray production
- 4.4 Gamma ray production
- 4.5 Gamma ray energy
- 4.6 Energy characteristics of common radioisotopes
- 4.7 Energy characteristics of X ray machine

5.0 Interaction of radiation with matter
- 5.1 Ionization
- 5.2 Radiation interaction with matter
- 5.3 Unit of exposure - the roentgen
- 5.4 Emissivity of sources
- 5.5 Emissivity of X ray devices
- 5.6 Attenuation of radiation, shielding
- 5.7 Half value layers
- 5.8 Inverse square law

6.0 Biological effects of radiation
- 6.1 Natural, background radiation
- 6.2 Unit of radiation dose
- 6.3 Radiation, contamination
- 6.4 Exposure limits and the banking concept
- 6.5 Theory of allowable dose
- 6.6 Radiation damage
- 6.7 Symptoms of radiation injury
- 6.8 Acute radiation exposure and somatic injury
- 6.9 Personnel monitoring for tracking exposure
- 6.10 Organ radiosensitivity

7.0 Radiation detection
- 7.1 Pocket dosimeter
- 7.2 Difference between dose and dose rate
- 7.3 Survey instruments
- 7.3 Geiger - Muller tube
- 7.4 Ionization chambers
- 7.5 Scintillation chambers, counters
- 7.6 Film badge
- 7.7 TLDs
- 7.8 Calibration

8.0 Exposure devices and radiation sources
- 8.1 Sealed source design and fabrication
- 8.2 Gamma ray sources
- 8.3 Beta and bremsstrahlung sources
- 8.4 Neutron sources
- 8.5 Exposure device characteristics
- 8.6 Generator - high voltage rectifiers
- 8.7 X ray tube design and fabrication
- 8.8 X ray control circuits
- 8.9 Accelerating potential
- 8.10 Target material and configuration
- 8.11 Heat dissipation
- 8.12 Duty cycle
- 8.13 beam filtration

9.0 Principles of Flash radiography, Stereo radiography, In-motion radiography, Autoradiography

10.0 Radiographic technique
- 10.1 Process of radiography
- 10.2 Penetrating ability or quality of X rays and gamma rays
- 10.3 Spectrum of X ray tube source
- 10.4 Spectrum of gamma radioisotope source
- 10.4 X ray tube - change of mA or kVp effect on quality and intensity

11.0 Geometric exposure principles
- 11.1 Shadow formation and distortion
- 11.2 Shadow enlargement calculation
- 11.3 Shadow sharpness
- 11.4 Geometric unsharpness
- 11.5 Finding discontinuity depth

12.0 Radiographic screens
- 12.1 Lead intensifying screens
- 12.2 Fluorescent intensifying screens
- 12.3 Intensifying factors
- 12.4 Importance of screen to film contact
- 12.5 Importance of screen cleanliness and care
- 12.6 Techniques for cleaning screens
- 12.7 Radiographic cassettes
- 12.8 Composition of Industrial radiographic film
- 12.9 The heel effect with X ray tubes

13.0 Radiographs
- 13.1 Formation of the latent image on film
- 13.2 Inherent unsharpness
- 13.3 Arithmetic of radiographic exposure
- 13.4 milliamperage
- 13.5 Reciprocity law
- 13.6 Photographic density
- 13.7 X ray exposure charts - material thickness, kV and exposure
- 13.8 Gamma ray exposure chart
- 13.9 Inverse square law considerations
- 13.10 Calculation of exposure time for gamma ray and X ray sources
- 13.11 Characteristic Hurter and Driffield curve
- 13.12 Film speed and class descriptions
- 13.13 Selection of film for particular purpose

14.0 Radiographic image quality
- 14.1 Radiographic Sensitivity
- 14.2 Radiographic Contrast
- 14.3 Film contrast
- 14.4 Subject contrast
- 14.5 Definition
- 14.6 Film graininess and screen mottle effects
- 14.7 Penetrameters or image quality indicators

15.0 Film handling, loading and Processing
- 15.1 Safe light and darkroom practices
- 15.2 Loading bench and cleanliness
- 15.3 Opening of film boxes and packets
- 15.4 Loading of film and sealing cassettes

15.5 Handling techniques for green film
15.6 Elements of manual film processing

16.0 Exposure techniques
16.1 Single wall radiography
16.2 Double wall radiography
16.3 Viewing two walls simultaneously
16.4 Offset double wall exposure single wall viewing
16.5 Elliptical techniques
16.6 Panoramic radiography
16.7 Use of multiple film loading
16.8 Specimen configuration

17.0 Darkroom facilities, techniques and processing
17.1 Facilities and equipment
17.2 Automatic film processor Vs manual processing
17.3 Safe lights
17.4 Viewer lights
17.5 Miscellaneous equipment
17.6 Cassette loading techniques for sheet and roll
17.7 Protection of radiographic film in storage
17.8 Processing of film - manual
17.9 Developer and replenishment
17.10 Stop bath
17.11 Fixer and replenishment
17.12 Washing
17.13 Prevention of water spots
17.14 Drying

18.0 Automatic film processing

19.0 Film filing and storage
19.1 Retention - life measurements
19.2 Long term storage
19.3 Filing and separation techniques

20.0 Film digitization techniques

21.0 Unsatisfactory radiographs - causes and cures
21.1 High film density
21.2 Insufficient film density
21.3 High contrast

21.4 Low contrast
- 21.5 Poor definition
- 21.6 Fog
- 21.7 Light leaks
- 21.8 Artifacts

22.0 Film density
- 22.1 Step wedge comparison film
- 22.2 Densitometers
- 22.3 Calibration and use of above equipments

23.0 Practical use of X ray and Gamma ray equipments

24.0 Radiological safety principles review
- 24.1 Controlling personnel exposure
- 24.2 Time, distance, shielding concepts
- 24.3 ALARA
- 24.4 Radiation detection equipment
- 24.5 Exposure device operating characteristics

25.0 Indications, discontinuities and defects
- 25.1 Indications
- 25.2 Discontinuities
- 25.3 Inherent
- 25.4 Processing
- 25.4 Service

26.0 Manufacturing processes and associated discontinuities
- 26.1 Casting processes and associated discontinuities
- 26.2 Ingots, blooms and billets
- 26.3 Sand casting
- 26.4 Centrifugal casting
- 26.5 Investment casting

27.0 Wrought processes and associated discontinuities
- 27.1 Forgings
- 27.2 Rolled products
- 27.3 Extruded products

28.0 Welding processes and associated discontinuities
- 28.1 SAW
- 28.2 SMAW
- 28.3 GMAW
- 28.4 FCAW
- 28.5 GTAW

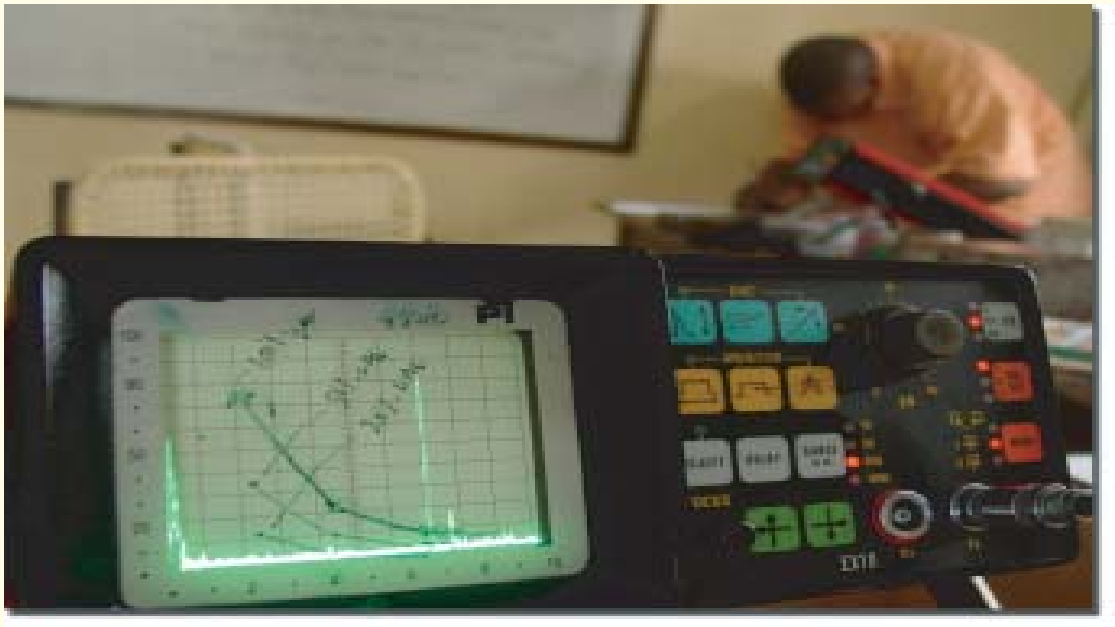
28.6 Resistance welding
28.7 Special welding processes - Electron beam, electroslag etc.
29.0 Introduction to Codes, Standards, Specifications and Procedures
29.1 Discussion on ASTM E 94 / E 142
29.2 Question answer session on above codes
29.3 Interpretation / Evaluation
29.4 Materials processing as it affects use of item and test results
29.5 Discontinuities, their causes and effects
29.6 Radiographic appearance of discontinuities
29.7 Nonrelevant indications
29.8 Film artifacts
30.0 Acceptance criteria

NDTTECH recommended training time for Level I / II - 80 Hours (10 Days)
Recommended training references: (1) ASNT Hand book on RT (2) Nondestructive Testing hand book, Robert Mc Master (3) SNT TC 1A The above could be considered the minimum delivery topics. Participants are expected to learn and answer questions from these topics in the Level I / Level II examination.

ULTRASONIC TESTING (UT)

Ultrasonic testing uses the transmission of high frequency sound waves into a material to detect imperfections within the material or changes in material properties.

The most commonly used ultrasonic testing method is Pulse echo, wherein sound is introduced into the test object and reflections are returned to a receiver from internal imperfections and geometrical surfaces of the part.



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Training topics for Level I / Level II UT

1.0 Definition of Ultrasonics
- 1.1 History of Ultrasonic Testing
- 1.2 Applications of ultrasonic energy
- 1.3 Basic math review
- 1.4 Responsibilities of levels of certification

2.0 Basic principles of acoustics
- 2.1 Nature of sound waves
- 2.2 Modes of sound wave generation
- 2.3 Velocity, frequency and wavelength of sound waves
- 2.4 Attenuation of sound waves
- 2.5 Acoustic impedance
- 2.6 Reflection
- 2.7 Refraction and mode conversion
- 2.8 Snell's law and critical angles
- 2.9 Fresnel effects

3.0 Equipment
- 3.1 Basic pulse echo instrumentation
- 3.2 A, B and C scan
- 3.3 Electronics - Time base, pulser, receiver and various monitor displays
- 3.4 Control functions
- 3.5 Basic instrument calibration
- 3.6 Calibration blocks
- 3.7 Digital thickness instrumentation

4.0 Transducer operation and theory
- 4.1 Piezo electric effect
- 4.2 Types of elements
- 4.3 Frequency
- 4.4 Near and far field
- 4.5 Beam spread
- 4.6 Construction, materials and shapes
- 4.7 Transducer types
  - 4.7.1 Normal
  - 4.7.2 Angle
  - 4.7.3 TR

4.8 Beam intensity characteristics
- 4.9 Sensitivity, resolution and damping
- 4.10 Mechanical vibration into part
- 4.11 Other types of transducers
  - 4.11.1 Paint brush
  - 4.11.2 Array
  - 4.11.3 Wheel

5.0 Couplants
- 5.1 Purpose and principles
- 5.2 Materials and their efficiency
- 5.2 Air coupled devices

6.0 Basic Testing methods
- 6.1 Contact
- 6.2 Immersion
- 6.3 Air coupling

7.0 Surface wave and plate waves
- 7.1 Applications of surface waves

8.0 Surface considerations
- 8.1 Flat and curved surfaces
- 8.2 Other geometrical changes

9.0 Pulse echo
- 9.1 Technique comparison

10.0 Through transmission

11.0 Video on immersion testing, Demonstration of Immersion testing system installed in the classroom

12.0 Alarms

13.0 Automatic and semiautomatic systems

14.0 DAC
- 14.1 Manual DAC
- 14.2 Electronic DAC
- 14.3 Use of DGS scales

15.0 Inspection calibration
- 15.1 Comparison with reference blocks
- 15.2 Pulse echo variables
- 15.3 Reference for planned tests
- 15.4 Transmission factors

15.5 Transducer
- 15.6 Couplants
- 15.7 Materials

16.0 Straight beam examination to specific procedures
- 16.1 Selection of parameters
- 16.2 Test standards
- 16.3 Evaluation of results
- 16.7 Test reports

17.0 Angle beam examination to specific procedures
- 17.1 Selection of parameters
- 17.2 Test standards
- 17.3 Evaluation of results
- 17.4 Test reports

18.0 Discontinuity detection on test specimens having natural and artificial discontinuities
- 18.1 Sensitivity to reflections
- 18.2 Size, shape and location of discontinuities
- 18.3 Techniques used in detection
- 18.4 Wave characteristics
- 18.5 Material and velocity

19.0 Resolution
- 19.1 Standard reference comparisons
- 19.2 History of part
- 19.3 Probability of type of discontinuity
- 19.4 Degrees of operator discrimination
- 19.5 Effects of frequency
- 19.6 Damping effects

20.0 Determination of discontinuity size
- 20.1 Various monitor displays and meter indications
- 20.2 Transducer movement Vs display
- 20.3 Two dimentional testing techniques
- 20.4 Signal patterns

21.0 Location of discontinuity
- 21.1 Amplitude and linear time
- 21.2 Search technique

22.0 Evaluation
- 22.1 Comparison procedures
- 22.2 Standards and references
- 22.3 Amplitude, area and distance relationship
- 22.4 Reference reflectors for calibration
- 22.5 FBH, Balls, Distance amplitude, Area amplitude, SDH
- 22.6 Application of results of other NDT methods

23.0 Codes, standards, Specifications and procedures
- 23.1 Understanding the concepts of Specifications

24.0 Short discussion on ASME Codes: ASME`Section V and VIII

25.0 Indications, discontinuities and defects
- 25.1 Indications
- 25.2 Discontinuities
- 25.3 Inherent
- 25.4 Processing
- 25.4 Service

26.0 Manufacturing processes and associated discontinuities
- 26.1 Casting processes and associated discontinuities
- 26.2 Ingots, blooms and billets
- 26.3 Sand casting
- 26.4 Centrifugal casting
- 26.5 Investment casting

27.0 Wrought processes and associated discontinuities
- 27.1 Forgings
- 27.2 Rolled products
- 27.3 Extruded products

28.0 Welding processes and associated discontinuities
- 28.1 SAW
- 28.2 SMAW
- 28.3 GMAW
- 28.4 FCAW
- 28.5 GTAW
- 28.6 Resistance welding
- 28.7 Special welding processes - Electron beam, electroslag etc.

29.0 Introduction to Codes, Standards, Specifications and Procedures
- 29.1 Discussion on ASTM A 435 / E 164
- 29.2 Question answer session on above codes
- 29.3 Interpretation / Evaluation
- 29.4 Materials processing as it affects use of item and test results
- 29.5 Discontinuities, their causes and effects
- 29.6 Ultrasonic interpretation of discontinuities
- 29.7 Noise / cross talk indications
- 29.8 Other considerations

30.0 Acceptance criteria

NDTTECH recommended training time for Level I / II - 96 Hours (12 Days minimum)
Recommended training references: (1) ASNT Handbook on UT (2) Nondestructive Testing hand book, Robert Mc Master, (3) Ultrasonic Testing of Materials, J & H Kraukramer (4) SNT TC 1A
The above could be considered the minimum delivery topics. Participants are expected to learn and answer questions from these topics in the Level I / Level II examination.

EDDY CURRENT TESTING (ET)
Eddy current Testing is based on the principle that a coil in air with alternating current flowing through it has unique and measurable resistive and inductive reactance components of it's electrical impedance.

Eddy currents are induced when an electrically conductive test object is placed close to the coil.

Mutual induction occurs and both components of the circuit impedance are changed by a given amount.

This change is based on frequency of AC used, proximity between probe coil and test part, dimensions of the test part, it's conductivity, permeability and the presence of flaws or discontinuities.

Training topics forLevel I / Level II ET

1.0 Introduction to Electromagnetic testing
- 1.1 Eddy current / Flux leakage
- 1.2 Brief history of testing
- 1.3 Basic principles of testing

2.0 Electromagnetic theory
- 2.1 Eddy current theory
- 2.2 Generation of eddy currents by means of an alternating current field
- 2.3 Effect of fields created by eddy currents (impedance changes)
- 2.4 Effect of change of impedance on instrumentation
- 2.5 Properties of eddy current
- 2.6 Travel in circular direction
- 2.7 Strongest on surface of test material
- 2.8 Zero value at center of solid conductor placed in an alternating magnetic field
- 2.9 Strength, time relationship and orientation as functions of test system
- 2.10 Have properties of compressible fluids
- 2.11 Small magnitude of current flow
- 2.12 Relationship of frequency and plane with current in coil
- 2.13 Effective permeability variations
- 2.14 Effect of discontinuity orientation
- 2.15 Powe losses

3.0 Flux leakage theory
- 3.1 Terminology and units
- 3.2 Principles of magnetization
- 3.3 BH curve
- 3.4 Magnetic properties
- 3.5 Magnetic field
- 3.6 Hysteresis loop
- 3.7 Magnetic permeability
- 3.8 Factors affecting permeability

4.0 Magnetization B electromagnetism theory
- 4.1 Oersted's law
- 4.2 Faraday's law
- 4.3 Electromagnetic

5.0 Flux leakage theory and principle
- 5.1 Residual
- 5.2 Active
- 5.3 Tangential leakage
- 5.4 Normal leakage fields

6.0 Readout mechanism
- 6.1 Calibrated or uncalibrated meter
- 6.2 Null meter with dial indicator
- 6.3 Oscilloscope and other monitor displays
- 6.4 Alarm, lights etc.
- 6.5 Numerical counters
- 6.6 Marking system
- 6.7 Sorting gates and tables
- 6.8 Cutoff saw or shears
- 6.9 Automation and feedback
- 6.10 Strip chart recorder

7.0 Eddy current sensing elements
- 7.1 Probes
- 7.2 Absolute
- 7.3 Differential
- 7.4 Lift off
- 7.5 Theory of operation
- 7.6 Applications
- 7.7 Advantages
- 7.8 Limitations

8.0 Through, encircling or annular coils
- 8.1 Absolute
- 8.2 Differential

9.0 Fill factor
- 9.1 Theory of operation
- 9.2 Applications

9.3 Advantages
9.4 Limitations
10.0 Factors affecting choice of sensing elements
10.1 Type of part to be inspected
10.2 Type of discontinuity to be inspected
10.3 Speed of testing required
10.4 Amount of testing required
10.5 Probable location of discontinuity

11.0 Comparison of techniques
11.1 Thickness gaging
11.2 Sorting
11.3 Conductivity
11.4 Surface or subsurface flaw detection
11.5 Tubing
11.6 Remote field

12.0 Practical workout
12.1 Using a Hocking Phasec instrument
12.2 Testing of a variety of components manually
12.3 Automation
12.4 Recording or storage of signals

13.0 Indications, discontinuities and defects
13.1 Indications
13.2 Discontinuities
13.3 Inherent
13.4 Processing
13.4 Service

14.0 Manufacturing processes and associated discontinuities
14.1 Casting processes and associated discontinuities
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15.1 Forgings
15.2 Rolled products
15.3 Extruded products

16.0 Welding processes and associated discontinuities
- 16.1 SAW
- 16.2 SMAW
- 16.3GTAW
- 16.4 Special welding processes - Electron beam, electroslag etc.

17.0 Introduction to Codes, Standards, Specifications and Procedures
- 17.1 Discussion on ASTM E 215, ASME Section V
- 17.2 Question answer session on above codes
- 17.3 Interpretation / Evaluation
- 17.4 Materials processing as it affects use of item and test results
- 17.5 Discontinuities, their causes and effects
- 17.6 Recognizing discontinuity indications
- 17.7 Nonrelevant indications
- 17.8 Relevant indications

18.0 Acceptance criteria

19.0 Report preparation

NDTTECH recommended training time for Level I / II - 48 - 64 Hours (6/8 Days minimum)

Recommended training references: (1) ASNT Handbook on ET (2) Nondestructive Testing hand book, Robert Mc Master (3) SNT TC 1A

MAGNETIC PARTICLE TESTING (MT)

Magnetic particle testing is done by inducing a magnetic field in a ferromagnetic material and dusting the surface with Iron particles.

Surface imperfections will distort the magnetic field and concentrate the iron particles near the imperfections, thus indicating their presence

Training Topics for Level I / Level II MT

1.0 Principles of magnets and magnetic fields
- 1.1 Theory of magnetic fields
- 1.2 Earth's magnetic field
- 1.3 Magnetic field around magnetized materials
- 1.4 Theory of magnetism
- 1.5 Law of magnetism
- 1.6 materials influenced by magnetic fields
- 1.7 Ferromagnetic
- 1.8 Paramagnetic
- 1.9 Magnetic characteristics of nonferrous materials
- 1.10 Terminology associated with magnetic particle tesing

2.0 Characteristics of magnetic fields
- 2.1 Bar magnet
- 2.2 Ring magnet

3.0 Effect of discontinuities
- 3.1 Surface cracks
- 3.2 Scratches
- 3.3 Subsurface defects

4.0 Magnetization by means of electric current
- 4.1 Circular field
  - 4.1.1 Field around a straight conductor
  - 4.1.2 Right hand rule
  - 4.1.3 Field in long, solid , cylindrical, regular parts
  - 4.1.4 Irregularly shaped parts
  - 4.1.5 Tubular parts
  - 4.1.6 Parts with machined slots and holes
  - 4.1.7 Method of inducing current flow in parts
  - 4.1.8 Contact plates
  - 4.1.9 Prods
  - 4.1.10 Dicontinuities commonly found with circular fields
- 4.2 Longitudinal field
  - 4.2.1 Field produced by current flow in a coil
  - 4.2.2 Field direction in a current carrying coil
  - 4.2.3 Field strength in a current carrying coil

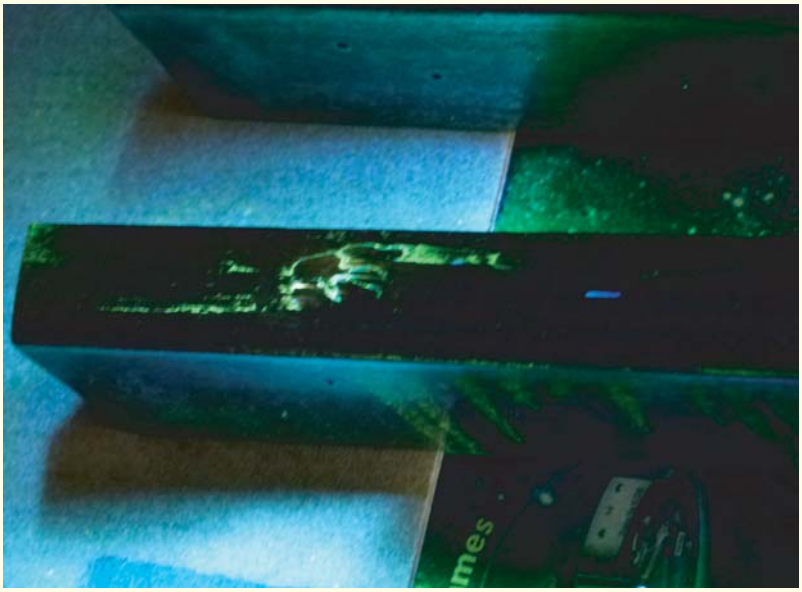
NDTTECH recommended training time for Level I / II - 24 Hours (3 Days minimum)
Recommended training references: (1) ASNT Handbook on MT (2) Magnetic Particle Testing hand book, Carl Betz (3) SNT TC 1A

PENETRANT TESTING (PT)

Liquid penetrant testing is probably the most widely used NDT method. The test object or material is coated with a visible or fluorescent dye solution. The excess dye is removed from the surface, and then a developer is applied.

The developer acts like a blotter. It draws penetrant out of the imperfections which are open to the surface. With visible dyes, the vivid color contrast between the penetrant and the developer makes the bleed out easy to see.

An ultraviolet lamp is used to make the bleed out fluoresce brightly, thus allowing the imperfection to be seen clearly.



Training topics for Level I / Level II PT

1.0 Introduction
- 1.1 Brief history of nondestructive testing and liquid penetrant testing
- 1.2 Purpose of testing
- 1.3 Basic principles of liquid penetrant testing
- 1.4 Types of penetrants commercially available
- 1.5 Method of personnel qualification

2.0 Liquid penetrant processing
- 2.1 Preparation of parts
- 2.2 Adequate lighting
- 2.3 Application of penetrant to parts
- 2.4 Removal of surface penetrant
- 2.5 Developer application and drying
- 2.6 Inspection and evaluation
- 2.7 Post cleaning

3.0 Various penetrant testig equipment
- 3.1 Liquid penetrant testing units
- 3.2 Lighting required for inspection
- 3.3 Light measurements
- 3.4 Materials for penetrant testing
- 3.5 Precautions in penetrant testing

4.0 Inspection and evaluation of Indications
- 4.1 Discontinuities inherent in various materials
- 4.2 Reason for indication
- 4.3 Appearance of indications
- 4.4 Time for indications to appear
- 4.5 Persistence of indications
- 4.6 Effects of temperature and lighting (WL to UV)
- 4.7 Effects of metal smearing operations
- 4.8 Preferred sequence for penetrant testing

4.9 Precleaning

5.0 Factors affecting indications
- 5.1 Penetrant used
- 5.2 Prior processing
- 5.3 Technique used

6.0 Indications from cracks
- 6.1 Cracks occuring during solidification
- 6.2 Cracks occuring during processing
- 6.3 Cracks occuring during service

7.0 Indications from Porosity
- 7.1 Forgings
- 7.2 Castings
- 7.3 Plate
- 7.4 Welds
- 7.5 Extrusions

8.0 Evaluation of Indications
- 8.1 True indications
- 8.2 False indications
- 8.3 Relevant indications
- 8.4 Nonrelevant indications

9.0 Process control

10.0 Indications, discontinuities and defects
- 101.1 Indications
- 10.2 Discontinuities
- 10.3 Inherent
- 10.4 Processing
- 10.4 Service

11.0 Manufacturing processes and associated discontinuities
- 11.1 Casting processes and associated discontinuities
- 11.2 Ingots, blooms and billets

12 Sand casting
- 12.1 Centrifugal casting
- 12.1 Investment casting

13.0 Wrought processes and associated discontinuities
- 13.1 Forgings
- 13.2 Rolled products
- 13.3 Extruded products

14.0 Welding processes and associated discontinuities
- 14.1 SAW
- 14.2 SMAW
- 14.3 GMAW
- 14.4 FCAW
- 14.5 GTAW
- 14.6 Resistance welding
- 14.7 Special welding processes - Electron beam, electroslag etc.

15.0 Introduction to Codes, Standards, Specifications and Procedures
- 15.1 Discussion on ASTM E 165, ASME`Section V
- 15.2 Question answer session on above codes
- 15.3 Interpretation / Evaluation
- 15.4 Materials processing as it affects use of item and test results
- 15.5 Discontinuities, their causes and effects
- 15.6 Recognizing discontinuity indications
- 15.7 Nonrelevant indications
- 15.8 Relevant indications

16.0 Practical workout
- 16.1 Procedure B3 on welds and other components
- 16.2 Procedure A3 on welds and other components]
- 16.3 Light measurements using light meter
- 16.4 Recording of indications
- 16.5 Acceptance criteria

17.0 Report preparation

NDTTECH recommended training time for Level I / II - 24 Hours (3 Days minimum)

Recommended training references: (1) ASNT Handbook on PT (2) Nondestructive Testing Hand book, Robert Mc Master (3) SNT TC 1A

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INTRODUCTION TO NDT

Introductory course covering the most commonly used NDT methods and techniques. An excellent course for those who are not directly involved in NDT.

Topics discussed includes ndt methods, materials & processes, discontinuities and their acceptance.

Offered to industries and individuals.

NDT SPECIAL APPLICATIONS (POST LEVEL II)

Post Level II courses are usually taken up by the experienced ndt and inspection professionals.

Inspection Supervisors, Engineers Inspectors and senior technicians attend these courses to enhance their knowledge base and for career growth.

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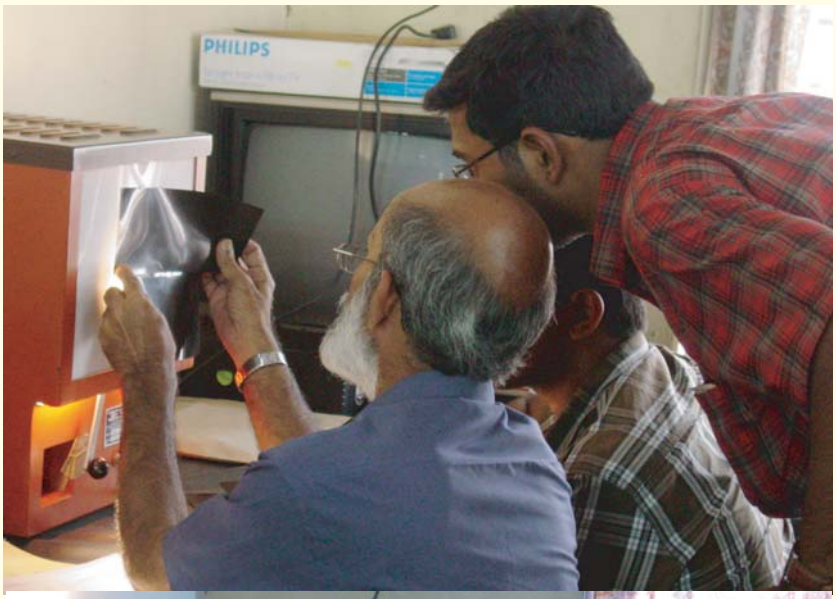
RADIOGRAPHIC FILM INTERPRETATION (RTFI)

The course is designed for the certified level II RT personnel. Various codes and standards are included along with a number of radiographs containing natural defects. (ASME Sec VIII, API 1104, AWS D 1.1, ASME B 31.3)

Radiographic films with natural and artificial discontinuities in welds are being provided for the practical.



Detailed acceptance – rejection criteria are being discussed during the class for a thorough understanding of the subject.Participant should be able to carry out film interpretation to the above codes independently upon completion of this course.

ULTRASONIC APPLICATIONS

LEVEL II A – ULTRASONIC TESTING OF PIPES FOR CORROSION

Course covering normal beam, TR inspection, sizing, mapping and recording of corrosion, HIC and other flaws found in plates and pipes of various sizes.

Participant should be able to carry out this work independently upon completion of this course. You would learn to set up, test and size corrosion, record, evaluate to a code or specification, isometric, A,B and C scan techniques.

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LEVEL II B – ULTRASONIC TESTING OF WELDS

Course covering plate and pipe butt weld examination per ASME sec VIII and AWS D1.1 Butt joints are being provided for the practical with designated blocks for the sensitivity setting and equipment verification

Participant should be able to carry out this work independently upon completion of this course.Note: Also see TOFD details on page 33.

You would learn to set up, test, detect, size, characterize and evaluate, record and report to the above codes.

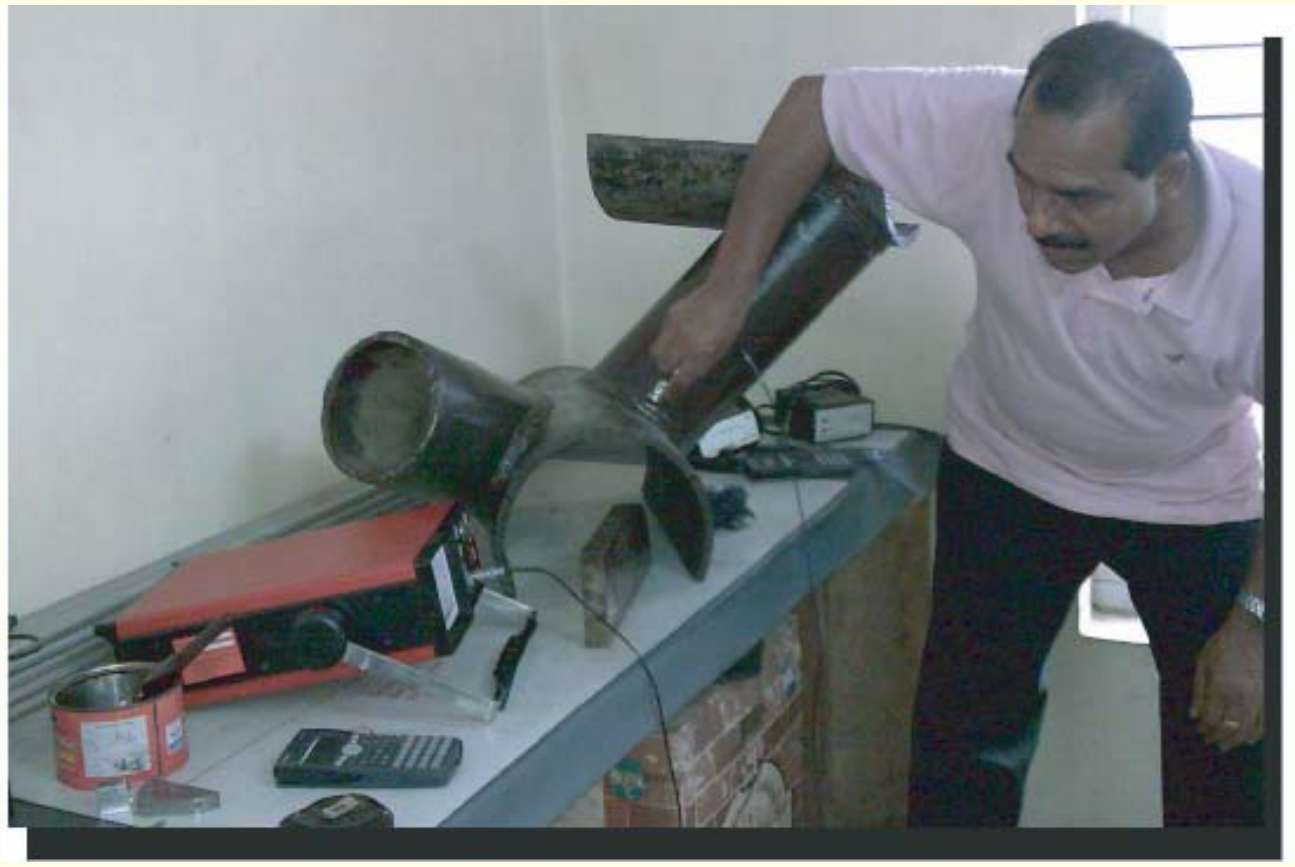
LEVEL II C – ULTRASONIC TESTING OF WELDS to API RP 2X (TKY JOINTS)

Course covering TKY weld examination per API RP 2X. Extensive practical on TKY welds shall be provided. Course includes detailed interpretation of API RP 2X.

This is a progressive training course and admission to Level IIC would require the candidate to pass Level II A and B. Participant should be able to carry out this work independently upon completion of this course. See next page for details.

The participant will be taught on the following with the help of UT equipment,reference blocks and flawed TKY specimen and other accessories:

^ Construction of Beam Profiles
^ Construction of DAC Curves
^ Flaw sizing techniques
^ Transfer correction
^ Mode conversion effects
^ Testing UFD for Vertical and Horizontal Linearity
^ Selection of probes
^ Reserve Gain
^ Internal Reflectors Limit for probes
^ Construction of weld cross section involving curvature using profile-gauge and other methods
^ Estimating change of angle, beam-path, surface distance for curved surfaces
^ Construction of a Flaw Locating Rule for TKY Weld Inspection
^ Applying different acceptance criteria
^ Report preparation



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ULTRASONIC IMMERSION TESTING / AUTOMATED UT (AUT)

Course covering detailed theory and applications involving automated systems and immersion testing practical.

Both UT and ET courses will carry an introduction to Automated testing. Course includes detailed discussion on set up parameters of Automated UT and immersion systems. Provides A, B and C Scan displays.

Separate course available on request

AUTOMATED EDDY CURRENT TESTING (AET)

Course covering detailed theory and applications involving automated systems.
Applications on the automated ET will be discussed and practical session using Automated ET equipment will be provided.

The participant will be taught on the set up parameters, operation, acquisition & evaluation of the test results and the code compliance. Provides A, B and C Scan displays.

Separate course available on request

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ULTRASONIC TIME OF FLIGHT DIFFRACTION (TOFD) Level II

Short, intensive courses are offered in Ultrasonic TOFD in collaboration with Electronic & Engineering Company India (P) LTD, Mumbai (www.eecindia.com) and EurosonicSAS, France.(www.eurosonic.com)

TOFD is a proven test method to scan welds of thickness >6mm, in a very short time and several major industries have acknowledged the advantages of this method.
TOFD equipment from Eurosonic SAS France, with scanner assembly, reference materials, test specimens will be used in the class.

Participants are taught on setting up, operation of the TOFD equipment, recording and evaluation of the test results.

Participant should be able to carry out this work independently upon completion of this course. Welding Inspectors, Plant Inspectors, NDT Technicians and Engineers will find this course very useful to their career. Offered to industries and individuals. Our training should help you operate not only Eurosonic equipment, but any other international equipments.

TOFD equipment above is capable of producing A, B and C scan displays. Code used: EN 473

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WELDING INSPECTION to AWS CWI / CSWIP 3.1 EXAMINATION

Preparatory course covering welding processes, materials, inspection, welders qualification, welding procedure qualification, use of the inspection gages and interpretation of the codes. This course will be very useful for those experienced NDT/ Inspection personnel who wish to appear for the American Welding Society's (www.aws.org) Certified Welding Inspector's examination or CSWIP 3.1 examination.

The course syllabus is formatted for the AWS & CSWIP(www.twi.co.uk) examination. AWS Certified Welding Inspector and or CSWIP 3.2 Senior Welding Inspector and ASNT Level III personnel will be delivering the lectures. Participants will be given mock exams during the course.

These courses are organized ahead of the AWS / CSWIP examinations in India and requires advance notification to ndttech. Kindly see the schedule for details.

INTRODUCTION TO ISO 9000 Quality Systems

Introductory course to the ISO 9000 series quality systems. This course will be useful for those who are working in an ISO 9000 certified organization or preparing for an ISO 9000 certification.

Those who are already in the Quality Control or Inspection divisions will find this course very advantageous for career advancements. ISO Certified Lead Assessor will be delivering the lectures.

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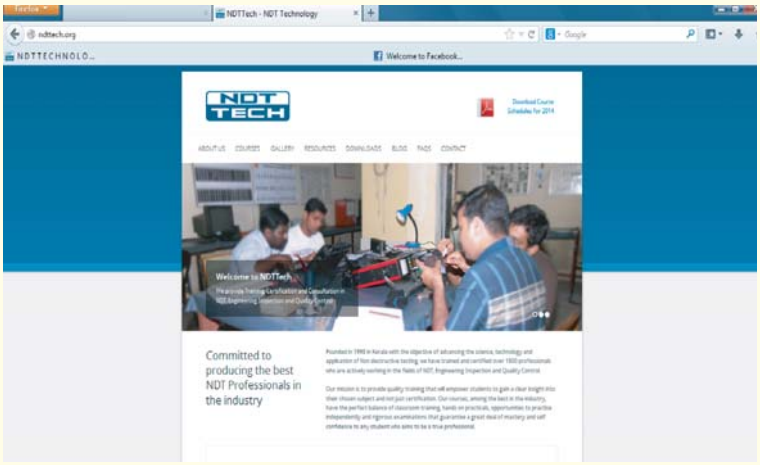
EXAMINATIONS



Three examinations will be taken in each method for Level I / II.

This will include (1) a closed book, General examination on the fundamentals of the subject, (2) An open book, Specific examination on any of the International code or standard provided and (3) a Practical examination with the equipment used in the method.

80% is the minimum required score to pass the exams. Multiple choice questions will be given for examinations.
Level I / II certificate will be issued to successful participants within 10 working days from the date of examination. Kindly see the "examination requirements" at : http://www.ndttech.org for more details on the examinations. Name, photograph and certification details of those who have passed our examinations are posted at the resource page of our website: http://www.ndttech.org All examinations will be in English.

RE-EXAMINATION

One free re-examination is offered to participants who have failed the first examination. The participant's score should be >50% in each paper to become eligible for this free course and examination. This re-examination should be taken within 6 months from the date of the first examination.
Participants who does not qualify in this mode may pay an additional 60% of the fee for re-examination. If this is not desired, then a course participation certificate will be issued.

NDT REFRESHER COURSES

This course (1) is designed for the level III aspirants and involves detailed theory, applications and class room exercises and class examinations. For Duration and Fee, please contact the course director.

(2) We also offer refresher courses to personnel who might require a thorough training, but may be possessing Level II certification from elsewhere. Call us for details.

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RENEWAL OF CERTIFICATES

Certificates will be issued for a period of 3 years and Free full refresher courses are being offered on renewal of our certification. We would advise to attend these free courses during renewal to keep you updated. This will also give you a chance to get familiar with the new technologies and instruments in the field. Please contact the course director or see the FAQ page at: www.ndttech.org for detailed renewal requirements / schedule and fee.

Certificates in original shall be sent to ndttech for renewal. Renewed certificates will be returned to the sender by courier on the same working day.

COURSE REGISTRATION

To appear Level II examinations, Participants are required to bring (1) copies of the level I certificate and work experience certificates. Those who have experience, but do not have the Level I certificate in the test method are required to pay for the additional training they may need for appearing the Level II examinations.

Participants are required to bring (2) 7nos. passport size photographs and (3) an eye test certificate from a registered ophthalmologist for vision acuity and color differentiation. Candidates shall also produce (4) attested copies of academic and professional certificates at the time of registration.

Participants are requested to carry (5) a scientific calculator for the course. (6) Full fee shall be paid at the start of the course. Course fee includes course material (Text, work books), stationery, coffee / tea and lunch.

Lodging available near NDTTECH at nominal rates.
Hotels / Resorts with independent villa facilities are also available near by.

If required, you may book your rooms in advance with these hotels.
http://www.arcadiahotels.net/
or
http://www.thewindsorcastle.net/
or http://www.hotelfairmont.in/.

Log on to www.ndttech.org for a current schedule or contact us for a specific date.

GENERAL - FOR ALL COURSES IN NDT

A brief introduction to NDT, Destructive Testing , Inspection techniques, materials and processes, type of defects, certification, employment, other NDT related courses etc will be discussed prior to the start of any Level I / II course.

Introduction also uses detailed video imported from ASNT and TWI. It is important that the participant attends this session in any course.

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Course schedule

Please confirm the course dates in advance by phone. Participants should make themselves available at the venue by 09:00 hours on the course date for registration. These are intensive training courses and the participants are expected to spend time during and after the daily class with the subject and should have sufficient time to complete the course. Check the following tables for fee and work experience requirements.

Method	Level I	Level II	LII Refresher	Other	Duration	Working Time
RT	₹ 10,900	₹ 11,500	₹ 11,000	N/A	10 Days *	09:00 - 16:30 *
UT	₹ 11,900	₹ 13,500	₹ 12,500	N/A	12 Days *	09:00 - 16:30 *
MT	₹ 5,000	₹ 8,500	₹ 8,250	N/A	3 Days *	09:00 - 17:30 *
PT	₹ 5,000	₹ 8,000	₹ 7,900	N/A	3 Days *	09:00 - 17:30 *
ET	₹ 11,900	₹ 13,500	₹ 13,000	N/A	8 Days *	09:00 - 16:30 *
WI	N/A	N/A	N/A	₹ 15,000	10 Days *	09:00 - 16:30 *
RTFI	N/A	N/A	N/A	₹ 16,500	8 Days *	09:00 - 16:30 *
UT ToFD	N/A	₹ 15,000	N/A	N/A	3 Days *	09:00 - 18:30 *
UT IIA	N/A	N/A	N/A	₹ 11,500	5 Days *	09:00 - 16:30 *
UT II B	N/A	N/A	N/A	₹ 12,500	6 Days *	09:00 - 16:30 *
UT II C TKY	N/A	N/A	N/A	₹ 18,000	10 Days *	09:00 - 16:30 *
UT IT / AUT	N/A	N/A	N/A	₹ 9,500	5 Days *	09:00 - 16:30 *

* Indicates the minimum training time. * Taxes extra. Fee includes course materials, lunch & refreshments.

Training & experience requirements				
	Training time required in Hours			Exp Required
Method	Level	High School	Diploma / Engg	in Months
RT	Level I	40	30	3
	Level II	40	35	9
UT	Level I	40	30	3
	Level II	40	40	9
MT	Level I	12	8	1
	Level II	8	4	3
PT	Level I	4	4	1
	Level II	8	4	2
ET	Level I	40	24	3
	Level II	40	40	9
Please carry copies of experience certificates for admission to Level II				

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Some frequently asked questions in India on NDT Training and certification. For more questions see the FAQ page at www.ndttech.org

Q1: My uncle has a company where he offers me a job. I need level II certificates in RT, UT, ET, MT and PT. I do not have much time now to attend the course, but I will surely study once I am on the job. I am looking for a crash course.
Ans: We can't help! We do not offer such crash courses. We offer only in depth courses for serious learners.

Q2: I have just completed my high school. I need level II certificates in RT, UT, ET, MT and PT.
Ans: You may join a preparatory course in NDT, that will let you work as a trainee for some time and when your employer realize that you are capable of handling work independently, he may offer you an examination and certification to level I or level II based on your academic qualifications and experience on a job. Even if you have level II or level III certificate, you may have to prove yourself on a job before the company takes you into their confidence. If you can't prove yourself then you are back to a trainee position.

Q3: I have an Engineering Degree / Diploma, can I take level II in RT, UT, ET, MT and PT directly? I do not have any experience in NDT or Inspection at all. I also want to take AWS CWI examination.
Ans: You may join a level II session of the chosen method if you qualify the experience requirements set forth in ASNT SNT TC 1A. If not, you begin at level I course. AWS CWI examination also requires you to have work experience.

Q4: How to register for a course & what are the class timings?
Ans: You may phone us and confirm your participation at least 5 days prior to the date of the course. Please refer the schedule for this year for dates. You may either come down to our office on the day before the course during working time or on the start date to fill up the registration form. Classes are taken from 09:30 to 16:30 hours.

Q5: What documents are required for registration?
Ans: Please carry copies of your SSLC / HSC certificate, Eye test certificate, employment proof, 7 nos. passport size photographs and full fee for the course.

Q6: What about the examinations? Do I get the certificate if I fail the test?
Ans: Each method will have 3 examinations. You need to score a minimum of 70 % in each paper and the average of these should be 80% for a pass. If you fail the test, you may opt for a free re-examination, subject to conditions. It is you who have to study the subject. We will provide you all possible assistance in learning the subject. Certificates will be issued only if you pass the examination.

Q7: What if I do not attend the course fully after registration due to personal reasons? Do I get another chance?
Ans: Yes, subject to conditions.

Q8: Do you provide placements after the course?
Ans: No. We can possibly provide the name of companies who may be recruiting. It is your responsibility to contact them for an appointment & possible interview.

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Some frequently asked questions in India on NDT Training and certification.

Q9: Upon completion of the course, will I be able to do the work independently?
Ans: Yes, You should be. That is exactly what we are trying to provide you with the lectures, equipments and reference materials.
Q10: Is there any technical support on the subject on a test work after the course and certification?
Ans: Yes, you may call us any time on +91 481 2361887 or e mail us at: ndttech@sancharnet.in with specific details of the work and your doubts.
Q11: Why are these equipments needed for the course? Can we not learn the testing on a computer?
Ans: NDT essentially uses some kind of portable or stationary equipment which you may have to carefully calibrate for an accurate test result. NDT tests can only give you some indications on the defects that may be there in a material. Therefore it is important that you are very familiar with the instrument, controls and the materials. In most work situations, you may have to pass a qualifying test before you actually begin the job. This would require you to learn not only the theory, but also the codes and its acceptance criteria. Just seeing an equipment or seeing a picture of an equipment will not help! You should use it on a variety of materials to learn the operation. Such proper learning takes time. Certain computer program designed for this purpose may help understand the theory.
Q12: Why should I learn to use these equipments? I am not a Technician, I am an Engineer / Supervisor.
Ans: Unless you know the proper usage, you would not be in a position to rectify a problem. How long a company would pay an Engineer / supervisor without having relevant exposure to the required work? In a case where they did, how long one can possibly continue in that service? Supervisors who does not know the work may be taken for a ride by the knowledgeable technicians or contractors! Quality companies would look for quality men and not just anyone with a certificate! Consider a situation where the company learns that you have a level II / level III certificate, but you have seen the basic instruments only in picture!
Q13: How come I can't attend Level II examinations? I am a graduate engineer. Why a correspondence course and Level II certification is not offered?
Ans: Refer to answer in question 3, 11 and Inquiries in the sixth edition of Interpreting SNT TC 1A
Q14: How to reach us?
Pallom is about 6 Km from Kottayam town towards Trivandrum. You may get buses from the Railway / Bus stations that runs on the M.C. Road towards Changanasserry or Trivandrum or take a rickshaw to Pallom. For those who travel by bus, get down at 'SBT Pallom'. Those who get down at the Kottayam Railway station would find private buses from the Railway station to Pallom. You may take the KSRTC buses from the KSRTC station to Pallom as well. Super fast, Fast passengers and Limited stop buses may not stop at 'SBT Pallom'. In case of doubt, please call: 9447705887 or Mr Biju Cherian on 9847305268.

Some of the hotels near by offers a special rate to our students who take up a room for a week or more. All hotel expenses shall be born by the students and NDTTECH will not be liable for any unpaid bills.

You may check these hotels online: www.arcadiahotels.net or www.thewindsorcastle.net or this one on the other end of town www.hotelfairmont.in. A quick search in Google for 'Hotels at Kumarakom, Kerala' will give you a choice. Kumarakom, an international tourist destination, is about 10KM from us.

There are ATM facilities near by. For students from other countries, please arrange to take up a mobile SIM card from the Airport as you arrive for keeping in touch with your family. Please call us in advance if hotel booking is needed.

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Few pictures from our classroom.

Mr. P.K. Kurien delivers the RT Level II course.

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Few pictures from our classroom.

Mr. Ahmed & Khalifa from Sultanate of Oman with Mr. P.K. Kurien after the RT Level II course.

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Few pictures from our classroom.

Mr Joseph and Tony in a UT Corrosion monitoring course

Mr. Lyster and Christian from M/s Amosco Corp, Nigeria in an Eddy Current Level II course.

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Few pictures from our classroom.

M/s Akinlade, Charles and Kingsley from JCI, Nigeria in an ET / Automated ET course and below in a UT Level II course.

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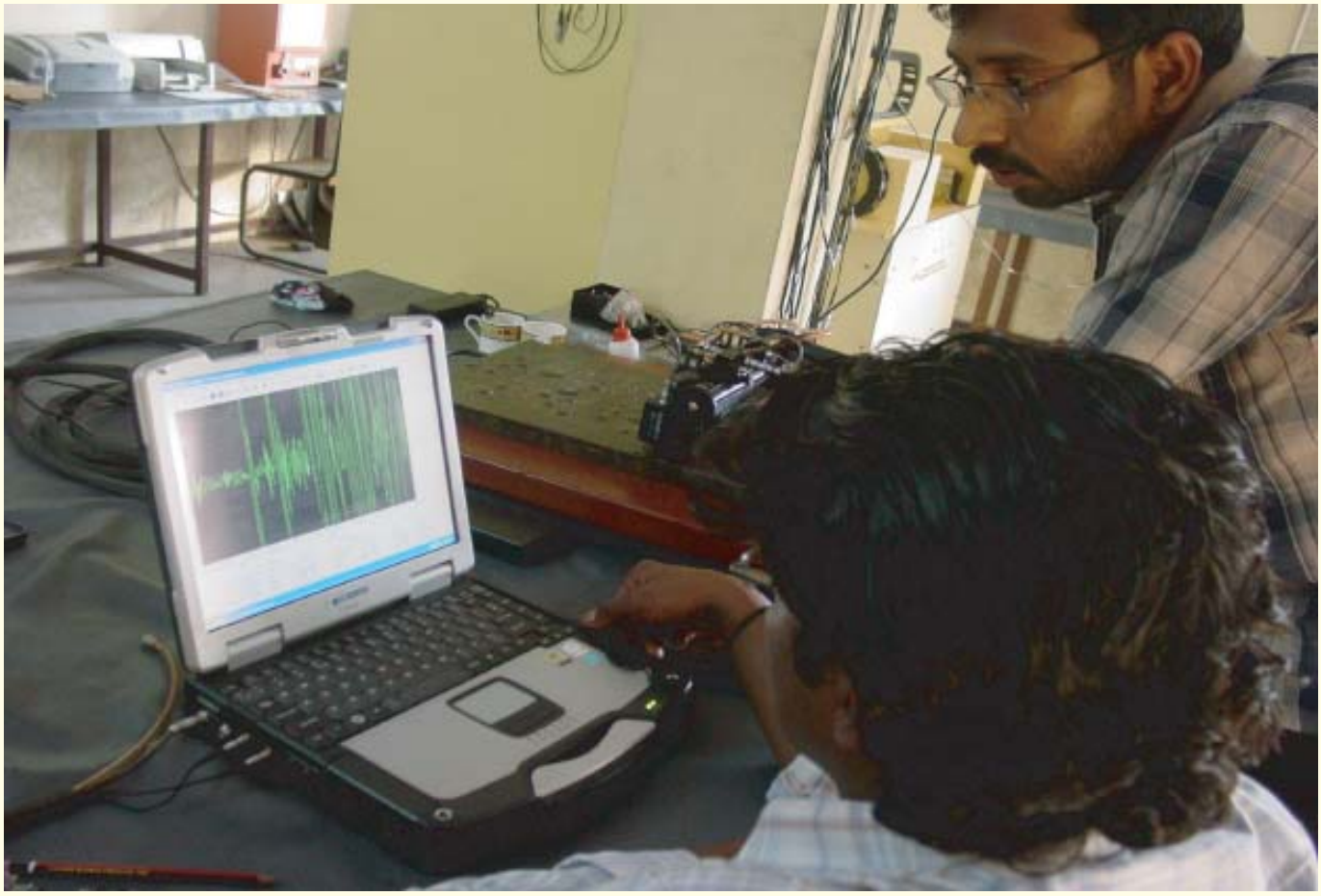
Few pictures from our classroom.

From the Ultrasonic class above and the TOFD class below.



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Few pictures from our classroom.

From the Ultrasonic TKY class

From the Ultrasonic Level I / Level II class. Students are being introduced to the Automated Ultrasonic Immersion Testing equipment.

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Few pictures from our classroom.

From the Eddy Current and RTFI class.

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