NDT LABS

Course Outline

Course Name: CGSB Prerequisite - M&P and NDT Mathematics

Course Description

The CGSB Prerequisite - M&P and NDT Mathematics course is an introductory program that teaches engineering materials and component fabrication, providing essential knowledge for detecting manufacturing defects and service-related damage in NDT. Students will learn about different material properties and structures, including steel, non-ferrous metals, and castings, as well as key fabrication methods such as metal forming, welding, and heat treatment. The course also covers mechanical testing, welding metallurgy basics, and defect detection, helping prepare students for the NRCan NDT M&P certification exam. Overall, it provides a comprehensive understanding of materials, fabrication processes, and inspection techniques.

Course Duration

Total 40 hours (100% Theory)

Delivery Method

Training takes place at A.I. NDT Labs Training Facility, located at #3120-580 Nicola Avenue, Port Coquitlam.

Course Curriculum

Section	Subject
1.Non-Destructive Testing	1.1 Introdiction to NDT 1.2 NDT Testing Methods 1.3 NDT Applications
2.Materials and Processes	2.1 General Material Properties 2.1.1 States of Matter a. Solid b. Liquid c. Gas d. Plasma 2.1.2 Properties of Matter a. Physical b. Mechanical c. Thermal d. Electrical e. Magnetic f. Acoustic 2.1.3 Atomic Structure a. Electrons, Protons, Neutrons 2.1.4 Material Groupings a. Metals i. Non-Ferrous ii. Ferrous b. Powder Metallurgy c. Non-Metals i. Plastics ii. Composites iii. Ceramics iv. Concrete 2.1.5 Structure of Metals a. Crystal Structures i. Body-centred cubic ii. Face-centred cubic iii. Hexagonal close-packed b. Phase Diagrams and Solubility c. Solidification of Metals i. Fine Equiax ii. Columnar Grains iii. Coarse Grain iv. Grain Boundaries 2.2 Iron and Steel Making Process 2.2.1 Iron Making Process a. Extractive Process b. Blast Furnace

2.2.2 Steel Making Process

a. Basic Oxygen Furnace
b. Electric Arc Furnace

2.2.3 Continuous Casting

a. Blooms, billets and slabs

2.2.4 Rolling Mill

2.3 Casting Processes and Defects

2.3.1 Casting metallurgy

2.3.2 Pouring and feeding castings

a. Casting design
b. Pouring
c. Gating system
d. Risers
e. Chills, Chaplets, and Cores

2.3.3 Sand moulding

a. Green sand moulds
b. Patterns
c. Flasks
d. Cores
e. Dry sand moulds

2.3.4 Special moulding processes

a. Shell moulds
b. Permanent mould casting
c. Investment casting
d. Plaster mould casting
e. Die casting
f. Centrifugal casting
g. Continuous casting

2.3.5 Casting Defects -Types, Location, and Causes

a. Cold shuts/cold shots
b. blowholes
c. hot tears
d. segregation
e. shrinkage
f. misruns
g. possibility, etc.
h. In-service Defects
    i. Fatigue cracks
    ii. Erosion

2.4 Metal Forming and Defects

2.4.1 Metallurgy of metal forming

a. Plastic deformation
b. Hot working and cold working
c. Work hardening and recrystallisation
d. Direction effects

2.4.2 Metal forming processes

a. Rolling
b. Extrusion
c. Tube and pipe making
d. Forging, open and closed die

2.4.3 Rolled extruded or forged defects - types, location, and causes

a. bursts
b. laminations
c. stringers
d. seams, laps, etc.
e. In-service Defects
    i. Fatigue cracks
    ii. Erosion

2.5 Ferrous and Non-Ferrous Materials

2.5.1 Ferrous Materials

a. Wrought Iron
b. Cast Iron
c. Carbon and Low Alloy Steels
d. Alloy Steels
e. Stainless Steels

2.5.2 Non-Ferrous Materials

a. Aluminium and alloys
b. Nickels and alloys
c. Copper and alloys
d. Magnesium and alloys
e. Titanium and alloys

2.6 Plastics and Composites

2.6.1 Plastics

2.6.2 Composites

2.7 Mechanical Properties and Testing

2.7.1 Mechanical properties

a. Toughness
b. Brittleness
c. Ductility
d. Malleability

2.7.2 Hardness Testing

a. Rocknell
b. Brinell
c. Vickers

2.7.3 Impact Testing

a. Charpy Test
b. Izod

2.7.4 Types of Forces

a. Tension

b. Torsion
c. Compression
d. Shear

2.7.5 Stress-Strain Diagrams

a. Yield Strength
b. Ultimate Tensile Strength
c. Fracture

2.7.6 Stress mechanisms

2.7.7 Fracture mechanisms

2.8 Heat Treating

2.8.1 Basic Metallurgy of Heat Treatment

2.8.2 Purpose of heat treatments and processes:

a. Quenching
b. Tempenng
c. Annealing
    i. Normalizing
    ii. Stress relieving
d. Surface hardening
e. Aging

2.9 Welding Processes and Defects

2.9.1 Welding metallurgy

a. Metallic bonding
b. Effects of composition, grain size and grain structure on the properties of welded joints
c. Distortion and stresses

2.9.2 Welding processes and (acronyms)

a. Shielded metal arc welding (SMAW)
b. Gas tungsten arc welding (GTAW)
c. Gas metal arc welding (GMAW)
d. Flux-cored arc welding (FCAW)
e. Submerged arc welding
f. Electroslag welding
g. Spot and seam welding
h. Soldering and brazing

2.9.3 Welding designs

a. Joint configurations
b. Basic symbols

2.9.4 Weld Defects - Types, Location, and Causes

a. inclusions
b. undercutting
c. porosity
d. cracks/HAZ cracks
e. incomplete penetration/excessive penetration
f. crater cracks
g. incomplete fusion
h. lamellar tearing, etc.
i. In-service Defects

	i. Fatigue cracks ii. Erosion 2.10 Corrosion 2.10.1 Corrosion mechanisms a. Cathode b. Anode c. Electrolyte forming the; i. Ionic current path ii. Electronic path 2.10.2 Types of Corrosion a. Electrochemical corrosion b. Uniform corrosion c. Galvanic corrosion d. Crevice corrosion (including Filiform and Poultice corrosion) e. Pitting corrosion f. Intergranular corrosion g. Stress corrosion cracking h. Fretting corrosion i. De-alloying corrosion 2.10.3 Corrosion Prevention a. Cathodic and Anodic Protection i. Sacrificial metals b. Coatings i. Paints ii. Plating iii. Anodizing iv. Galvanizing
3.Human Factors Affecting Quality of Testing	
4.NDT codes/standards (CAN/CGSB-48.9712-2014, NRCan/SGDB NDT Certification Process)	

What to bring

Students are required to bring a scientific calculator, pens, pencils, and a ruler to class.

Instructor

Our company has five certified instructors, each holding CGSB/CWB Level 2 and Level 3 certifications and P.Eng. designation in their respective NDT methods. They bring extensive industry experience and practical knowledge to ensure high-quality, professional training.

Entrance requirement

1) Majority

The age of majority requirement comes into effect for the date of certification issuance, not the application submission date.

*All participants must submit a copy of their ID to verify their legal age.

2) English Proficiency

Participants from abroad must demonstrate English proficiency to ensure successful participation in the course. Acceptable proof includes:

- CLB minimum 6, or
- Completion of a high school or post-secondary program in a country where English is the primary language (transcripts may be accepted).

NDT Mathematics

- Students who have not completed NDT Math are required to take it as a separate module before or alongside this course.
- The NDT Math course must be registered separately and has a tuition fee of $250.
- Students with valid transcripts showing equivalent math competency may be exempted.

Student Evaluation

1) Attendance

If a participant does not attend the course at least once, they cannot pass the course even if they receive a passing grade.

2) Quiz

The instructor may administer two quizzes throughout the course.

3) End-of-Course Exam

The end-of-course exam is administered after the completion of the entire course.

4) The Final Grade

The participants must achieve a passing grade (>= 70%) on the final examination for certification.

Remediation policy

- If the students fail the final course exam, he/she may re-take the one-time repeat exam in 2 weeks.
- The students who achieve a failing grade of 60% or above may apply to attempt a repeat exam immediately.