

**Outline for a recent 3 day seminar on**  
**Welding Process and Design for an Engineering & Construction firm**

**Basics of Metallurgy Principles**

Basics of Welding Metallurgy

Phase Changes, Fe-C diagram

Hardenability & heat treatments: mechanical properties

Heat treatment of welding

Carbon and Low Alloy Steels, CE

Preheat, PWHT, Temper Bead and Buttering

Weld Defect Types

Hydrogen Induced Cracking

Fatigue and Fracture

**Introduction to Arc Welding Processes**

Arc Welding Processes and Power Supplies

Shielded Metal Arc Welding (SMAW)

Gas Metal Arc Welding (GMAW)

Flux Core Arc Welding (FCAW)

Submerged Arc Welding (SAW)

Other processes

Cutting Processes

**Qualification and Certification Overview**

Welding Procedure Specifications

WPSs for arc welding

Qualification of procedures

Performance qualification

**Quality Assurance**

Approach to quality assurance

Destructive testing (tensile, hardness, bend, impact)

NDE Methods:

Visual Inspection

Penetrant Inspection

Magnetic Particle Inspection

Radiographic Inspection

Ultrasonic Inspection

**Welding Design – Design of Joints**

Symbols

Residual Stress and Distortion

Weld Sizing

CJP vs. PJP vs Fillet

Joint Design Rules of Thumb