

## Training Syllabus

### Regular Course curriculum for Ultrasonic testing of Axles & Wheels (Theoretical)

- ∅ Various NDT methods, their principle and application.
- ∅ Acoustics, sub-sonic, sonic and ultrasonic waves and their industrial applications, ultrasonic for non-destructive testing and ultrasonic spectrum.
- ∅ Ultrasonic waves, mechanical waves through an elastic body, parameter of a wave, definition and units of wave parameters, decibel, wave-length and dimension of a given flaw.
- ∅ Ultrasonic waves- longitudinal, transverse and surface waves.
- ∅ Properties of sound wave- reflection, refraction diffraction, absorption and scattering.
- ∅ Transmission of ultrasonic waves from one medium to another at a normal incidence and at an angle to the boundary.
- ∅ Conversion of ultrasonic waves- trajectory No. 1,2 & 3.
- ∅ Piezo- electric transducer, piezo- electric effect, properties and design of quartz crystal, Barium titanate, Lithium sulphate, Lead meta niobate, PZT.
- ∅ Probes used in ultrasonic testing, normal probes, angle probes, calibration and checking of probes.
- ∅ Principle, application and testing of pulse echo reflection method.
- ∅ Block diagram of a flaw detector, principle and working of different parts.
- ∅ Important characteristics of ultrasonic flaw detector.
- ∅ Scanning techniques- far end, near end- Low angle and High angle procedure of testing.
- ∅ Axle metallurgy and axle defects.

### Regular Course curriculum for Ultrasonic testing of Axles & Wheels (Practical)

- ∅ Familiarization with different control keys of UFD.
- ∅ Horizontal scale calibration of UFD for different ranges.
- ∅ Horizontal scale calibration of UFD for shear waves.
- ∅ Characteristics checking of UFD and probes.
- ∅ Far-end scanning of axles.
- ∅ UST of axles using Trace Dealy technique.
- ∅ Near- End Low Angle scanning.
- ∅ High angle scanning.
- ∅ UST of wheel disc.

### **Regular Course curriculum for Ultrasonic testing of Rails & Rail Welds (Theoretical)**

- ∅ Various NDT methods, their principle and application.
- ∅ Acoustics, sub-sonic, sonic and ultrasonic waves and their industrial applications, ultrasonic for non-destructive testing and ultrasonic spectrum.
- ∅ Ultrasonic waves, mechanical waves through an elastic body, parameter of a wave definition and units of wave parameters, decibel, wave-length and dimension of a given flaw.
- ∅ Ultrasonic waves- longitudinal, transverse and surface waves.
- ∅ Properties of sound wave- reflection, refraction, diffraction absorption and scattering.
- ∅ Transmission of ultrasonic waves from one medium to another at a normal incidence and at an angle to the boundary.
- ∅ Piezo-electric transducer, piezo- electric effect, properties and design of quartz crystal, Barium titanate Lithium, sulphate, Lead meta niobate, PZT.
- ∅ Probes used in ultrasonic testing, normal probes, angle probes, calibration and checking of probes.
- ∅ Principle, application and testing of pulse echo reflection method.
- ∅ Need based concept of testing.
- ∅ Block diagram of a flaw detector principle and working of different parts.
- ∅ Important characteristics of ultrasonic flaw detector.
- ∅ Ultrasonic testing of Rails, calibration and sensitivity setting, function of probes.
- ∅ Criteria for defect classification.
- ∅ Frequency of testing codification of defects.
- ∅ Ultrasonic testing of AT, FB and GP Welded rail joints.
- ∅ Ultrasonic testing of SEJ.
- ∅ Rail metallurgy and rail defects.

### **Regular Course curriculum for Ultrasonic testing of Rails & Rail Welds (Practical)**

- ∅ Familiarization with different control keys of UFD.
- ∅ Horizontal scale calibration of UFD for different ranges.
- ∅ Horizontal scale calibration of UFD for shear waves.
- ∅ Characteristics checking of UFD and probes.
- ∅ Sensitivity setting of UFD for UST of rails.
- ∅ Ultrasonic testing of rails on track.
- ∅ UST of AT Welded rail joints.
- ∅ UST of FB & GP welded rail joints.

### Refresher Course curriculum for Ultrasonic testing of Axles & Wheels

- Ø Axle Metallurgy, axle specification and defects in axles.
- Ø Re-capitulation of basic fundamentals of ultrasonic waves.
- Ø Assessment of UFD and accessories.
- Ø Panel discussion on problems related to UST of Axles & wheels and equipment.
- Ø Latest development in UST of axle and wheels.
- Ø Practical demonstration of new techniques/equipments.

### Refresher Course curriculum for Ultrasonic testing of Rails & Rail Welds.

- Ø Rail Metallurgy, rail specification and defects in rails.
- Ø Re-capitulation of basic fundamentals of ultrasonic waves.
- Ø Assessment of UFD and accessories.
- Ø Panel discussion on problems related to UST of rails & rails welds and equipment.
- Ø Latest development in UST of rails and welds.
- Ø Practical demonstration of new techniques/equipment.

### Course curriculum for Course on UST of AT&FB Welded rail joints.

#### A. THEORETICAL

- Ø Non-destructive testing of materials.
- Ø Sub-sonic, sonic & ultrasonic waves, types of sound waves and their properties.
- Ø Transmission of ultrasonic waves from one medium to another, mode conversion of sound waves.
- Ø Probes used in UST of AT & FB welded Rail Joints.
- Ø UST of AT welded Rail Joints. Sensitivity setting & testing.
- Ø Assessment of Ultrasonic Flaw Detector & Probes.

#### B. PRACTICAL

- Ø Familiarization with different control keys of UFD.
- Ø Horizontal scale calibration of UFD.
- Ø UST of AT welded Rail Joints.
- Ø UST of FB welded Rail Joints.
- Ø Assessment of Ultrasonic Flaw Detector & Probes.