



ENGINEERING STAFF COLLEGE OF INDIA



Autonomous Organ of The Institution of Engineers (India)
(IMS [ISO 9001:2015, ISO 14001:2015, ISO 50001:2018, ISO 45001:2018],
ISO/IEC 17025:2017 Certified, AICTE & CEA Recognized Institution)
Old Bombay Road, Gachibowli, Hyderabad – 500 032. Telangana, India

Management and Technology Division

Hybrid (Offline & Online) Continuing Professional Development Programme on

Advanced Welding Technology with NDT and Failure Analysis

Dates: 18 – 22 January 2027
at ESCI Campus, Hyderabad

INTRODUCTION

Welding is a fundamental manufacturing and fabrication process widely used in engineering industries for joining metals and ensuring structural integrity. Advances in welding technology have significantly improved the quality, efficiency, and reliability of welded structures across sectors such as automotive, aerospace, power plants, marine, and heavy engineering. A strong understanding of welding processes, parameters, and quality control techniques is essential for producing defect-free and high-performance joints.

Non-Destructive Testing (NDT) plays a vital role in evaluating the integrity of welded components without causing damage to the material. Techniques such as visual inspection, ultrasonic testing, radiographic testing, magnetic particle testing, and dye penetrant testing are widely used to detect internal and surface defects. Combined with failure analysis, these methods help engineers identify root causes of structural failures, improve design reliability, and enhance safety standards in critical engineering applications.

Through a combination of theoretical sessions, participants will learn how to apply NDT techniques to evaluate welded joints and correlate inspection results with possible failure mechanisms. The program also focuses on practical failure analysis approaches to identify root causes of weld defects, enabling participants to improve weld quality, enhance structural reliability, and implement effective quality assurance practices in engineering applications.

OBJECTIVES

The main objective of the programme is to:

- Understand the fundamental principles of advanced welding processes and their applications in engineering industries.
- Identify common welding defects and understand their causes related to process parameters, materials, and fabrication practices.
- Gain knowledge of Non-Destructive Testing (NDT) methods and their role in evaluating weld quality and structural integrity.
- Interpret NDT results to assess surface and subsurface discontinuities in welded components.
- Understand the basics of failure analysis and its application in identifying root causes of weld-related failures.
- Integrate welding technology, NDT techniques, and failure analysis concepts to improve quality assurance and reliability in engineering structures.

COURSE COVERAGE

The following course content will be detailed during the training programme:

A. Welding Technology

1. Welding Processes and Advancements

- Overview of conventional welding processes (SMAW, GMAW, GTAW, SAW)
- Mechanized and automated welding systems

- Selection of welding processes based on materials and applications
- 2. Welding Metallurgy and Weld Behavior**
 - Weld metal solidification and microstructural evolution
 - Heat affected zone (HAZ) characteristics and phase transformations
 - Influence of metallurgy on weld strength, toughness, and integrity
- 3. Welding Codes, Standards and Procedure Documentation**
 - Overview of ASME Section IX, AWS D1.1, and ISO standards
 - Welding Procedure Specification (WPS) structure and application
 - Procedure Qualification (PQR) and Welder Qualification (WPQ) requirements
- 4. Welding Design, Parameters and Quality Control**
 - Selection of welding parameters (current, voltage, travel speed, heat input)
 - Joint design and fit-up practices
 - Distortion control and residual stress management
 - Welding quality assurance practices in fabrication

B. NDT and Failure Analysis

- 5. Introduction to NDT Methods for Engineering Materials**
 - Overview of NDT techniques for welds, castings, forgings, and tubes
 - Ultrasonic Testing (UT), Radiographic Testing (RT), Liquid Penetrant Testing (PT), Magnetic Particle Testing (MT), and Eddy Current Testing (ET)
 - Basic principles and applications of each method
- 6. Advanced NDT Techniques and Developments**
 - Digital and real-time radiography applications
 - Industrial Computed Tomography (CT)
 - Electromagnetic techniques for residual stress measurement
 - Advances in inspection technologies for complex components
- 7. Failure Analysis and Root Cause Investigation**
 - Failure analysis of weldments, castings, forgings, and tubes
 - Identification of defect-related failures and damage mechanisms
 - Metallurgical and mechanical evaluation in failure investigation
- 8. Acceptance Standards, Case Studies and Quality Reliability**
 - Acceptance standards for welds, castings, forgings, and tubes
 - Root cause analysis (RCA) methodology
 - Total Quality Management (TQM) in manufacturing
 - Case studies on industrial failures and corrective actions

METHODOLOGY

Methodology of the Programme includes classroom Sessions with Lecture/discussion with audio visual aid, benchmarked practices if any, video shows, Chalk & Talk sessions, group discussions, case studies, debates, sharing of experiences, etc. All the sessions will be interactive demanding active participation from all the members.

TARGET PARTICIPANTS

Engineering Executives, Scientists, Technical officers, Technicians from various Defence Labs, Engineering managers, supervisors working in production, welding, R&D units, process planning, designs, maintenance and Quality Control / Quality Assurance in manufacturing and process industries like heavy equipment fabrication sectors, automobile, defence, aeronautical, electronics, power sectors (Generation–Thermal, Nuclear, Gas) medical products & precision instruments, petrochemicals, fertilizers, ordnance factories, public & private sectors enterprises will be highly benefited by attending the programme.

BENEFITS TO THE PARTICIPANTS

- Understand modern welding processes and their industrial uses.
- Learn proper selection of welding methods and parameters.
- Gain knowledge of welding codes, standards, and documentation.
- Identify defects using key NDT techniques.
- Develop basic skills in failure analysis and root cause identification.
- Improve awareness of quality control and inspection practices.

EXPERT FACULTY

The faculty for the programme consists of Eminent Experts from various Research and Manufacturing organisations besides the core faculty from ESCI.

PROGRAMME DIRECTOR

Dr. U.S. JYOTHI, FIE

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PROGRAMME DATES & TIMINGS

Dates: 18 – 22 January 2027

Timings : On the first day Registration will commence at **09:00 Hrs**. On all other days the programme timings will be from **09:45-17:15 Hrs** with breaks in between for tea and lunch.

COURSE FEE: Rs. 27,500/- (**Rupees Twenty Seven Thousand & Five Hundred only**) per Participant + GST@18% Extra. Fee includes, course material, course kit, twin-sharing AC accommodation as per availability, breakfast, lunch, dinner, tea / coffee and snacks during the actual days of training programme.

Online: WebEx platform.

Rs. 17,500 /- (Rupees Seventeen Thousand and Five Hundred only) per participant + GST@18% is extra.

DISCOUNTS

- **Non-Residential Fee:** 10% discount on course fee is allowed for non-residential participants.

PAN Card No AAATT3439Q; GST No. 36AAATT3439Q1ZV. H.S. No. 999293 (Under commercial training or coaching services – clause 65(105) (ZZC) of Finance act – 1994).

Programme fee is to be paid in in favor of **“THE INSTITUTION OF ENGINEERS (INDIA) – ENGINEERING STAFF COLLEGE OF INDIA”** in the form of demand draft payable at Hyderabad. Alternatively, the payment may be made by Electronic Fund Transfer (EFT) to ESCI - **SB A/c No.0432104000039631 with The IDBI Bank Ltd., Gachibowli Branch, Plot No. 2-53/2, JNIBF, IIIT Junction, Gachibowli, Hyderabad-500032 by RTG's/ NIFT / IFSC Code No: IBKL0000432**. While using EFT method of payment, please ensure to communicate us your company name, our Invoice reference and programme title.

CERTIFICATION

A Certificate of participation will be awarded to each participant on conclusion of the programme.

GENERAL INSTRUCTIONS

- ESCI encourages participants to present case studies from their respective organizations.
- ESCI provides complimentary accommodation and boarding to the participants one day before commencement (Check-in 1200 h) and one day after conclusion (Check-out 1200 h) of the programme duration. Overstay charges will be applicable as per ESCI rules (subject to availability of accommodation).
- Well-developed Information Centre and Internet facilities are available to the participants free of cost.