

## Exam Pattern

Examination	Number of Questions	Duration	Min % to Pass	Exam Pattern Multiple Choice
Online Prometric Exam				
Part 3-Welding Related Disciplines (Essay Exam)	60	2 Hrs	60 %	Closed Book
Part 4- Practical Welding and Related Applications	40	2 Hrs	60 %	Closed Book

Minimum Weighted Percentage for all Four Parts

## Registration Process

All the registrations are to be completed preferably Five (5) weeks prior to the commencement of seminar with full payment to avoid disappointment. For more information call us on 9840175179 / 9551665683.

E-mail: registration@welding-certification.com /rg\_ganesan@yahoo.com Upon completion of registration process, candidates can collect their Hard copy of study materials and AWS QC1:2016 Specification for AWS Certification of Welding Inspectors. This will help candidates to start their preparations immediate

## Mode of Payment

The Seminar fees **Rs.45,000/-** Must be made in Indian Rupees by Bank Draft or Wire Transfer to the Following Account.

Name : BETZ Educational & Research Division  
Bank : KARUR VYSYA BANK LTD Branch : ALANDUR  
Account Number : 1104115000021458 IFSC : KVBL0001104

**The Examination Fee USD800 made by Wire Transfer to the following Account**

Bank Name : JP Morgan Chase Account No : 507618335  
Routing Number : 322271627 Swift Code : CHASUS33  
Bank Address : JP Morgan Chase  
334 S Diamond Bar Blvd Diamond Bar, CA 91765, USA  
Betz Engineering Inc.  
23535 Palomino Drive, #371 Diamond Bar, CA 91765, USA



Appropriate Course Materials will be provided well-in advance during registration, to help you prepare for the exam. Seminar kit will be provided during the first day of seminar.

Lunch and Refreshments will be provided during the seminar and exam



After completion of the seminar and 40 hours Training, Course completion certificate will be provided.

A/C Accommodation will be provided during the seminar on first come first serve basis (4 Rooms / 10 Bed only)



## Traning Venue :

### BETZ ENGINEERING & TECHNOLOGY ZONE

Door # 21, Dharakeshwari Nagar 1st Street,  
Sembakkam, Tambaram to Velacherry Main Road,  
Chennai – 600 073, INDIA.

Tel: +91 44 - 4262 5390

Mobile: 9840175179 / 9551665681 / 83

E-mail: rg\_ganesan@yahoo.com,  
registration@welding-certification.com

[www.welding-certification.com](http://www.welding-certification.com)



# AMERICAN WELDING SOCIETY CERTIFIED WELDING ENGINEER

**AWS - CWEng  
Part # 3 & 4**



## BETZ ENGINEERING & TECHNOLOGY ZONE

Educational & Research Division



TC - 4028

## Certification Program for the Year - 2022



**BETZ is the only Accredited Test Facility in India  
for American Welding Society, USA.**

**BETZ is also an International Agency for AWS to conduct  
Seminars and Certification Exams.**

[www.welding-certification.com](http://www.welding-certification.com)

## About Us

BETZ Engineering & Technology Zone is an accredited International Agency for American Welding Society, Florida, U.S.A., to conduct Seminars and Certification Programs for AWS in India and Worldwide. BETZ is an ISO 9001:2015 company, also BETZ is the Only 'ATF – Accredited Test Facility' of AWS to evaluate and certify welders in India.

Individuals with AWS Certified Welding Engineer certification have demonstrated their skills for preparing or reviewing written instructions for the production of welded joints. They are thoroughly familiar with various codes, specifications, standards and other aspects of fabrication and assembly. The CWEng often prepares and produces reports, which accurately reflect professional judgment and is able to work with management representatives, inspection personnel, welders and support crafts, understanding the integrated role of each in the development of weldments

BETZ has been assessed and accredited by NABL in accordance with the standard ISO/IEC/17025 in the field of Testing, Non-Destructive Testing & Mechanical Testing Certificate #TC 4028

### AWS-CWEng Part# 3 & 4 SCHEDULE-2022

Month	SITE	AWS CWE Part # 3&4	Seminar City	Online Exam Date
January	IN76022	25 to 30	Chennai	January 31, 2022
February	IN76122	23 to 28	Chennai	February 28, 2022
March	IN76222	25 to 30	Chennai	March 31, 2022
April	IN76322	24 to 29	Chennai	April 30, 2022
May	IN76422	25 to 30	Chennai	May 31, 2022
June	IN76522	24 to 29	Chennai	June 30, 2022
July	IN76622	25 to 30	Chennai	July 31, 2022
August	IN76722	25 to 30	Chennai	August 31, 2022
September	IN76822	24 to 29	Chennai	September 30, 2022
October	IN76922	25 to 30	Chennai	October 31, 2022
November	IN77022	24 to 29	Chennai	November 30, 2022
December	IN77122	24 to 29	Chennai	December 30, 2021

Application must be emailed to BETZ no later than (5) weeks before the test date

## Eligibility

- Having Bachelor of Engineering (B.E) degree and a minimum of one (1) year relevant experience.
- Having Bachelor of Technology (B.Tech.) degree and a minimum of two (2) years relevant experience.
- Having other related Bachelor of Science (B.Sc.) degrees and a minimum of five (5) years of relevant experience.
- Having an Associate in Applied Science (A.A.Sc.) degree and a minimum of ten (10) years of relevant experience.
- who have successfully completed high school or an equivalent program and a minimum of fifteen (15) years relevant experience.

## Exam pattern

The AWS Certified Welding Engineer (CWEng.) examination consists of four parts. Parts 1 and 2 must be successfully completed in order to take Parts 3 and 4. The first two parts (1 and 2) of the exam are closed book and covers fundamentals of basic science and applied science. Exam will be of two hours for each part of written type with multiple-choice questions (total time of four hours). Part 1 consists of 35 questions of multiple choice and Part 2 has 25 questions of multiple choice. Both the Parts are given together and must be passed together. If the candidate fails in any one part, only that part must be repeated.

Examinations for Parts 3 and 4 are open book examinations on welding related disciplines and practical welding and related applications. Each examination is three hours in length (Duration). Part 3 has 45 questions of essay type. Part 4 has 39 questions of multiple choice type. Candidates that **successfully pass Parts 1 and 2 will be invited to sit for Part 3 and Part 4 examinations and a separate application must be submitted to AWS.**

Candidates must pass each of the four examination with an individual score of not less than 60% and attain a minimum weighted percentage of 70% for all 4 parts.

## Seminar Pattern - Part # 3 & 4

These Seven days course focuses on the knowledge in welding related disciplines and practical welding related applications.

### Part 3 – Welding Related Disciplines (Essay Exam)

3 days seminar will be conducted to cover the NDE/Weld Discontinuities, Welding Heat Sources and Arc Physics, Welding Processes and Controls, Welding and Joining Metallurgy, Weld Design, Brazing and Soldering.

### Part 4 – Practical Welding and Related Applications

3 days seminar will be conducted to cover the Welding safety, weldment design, welding metallurgy, materials, welding process selection, NDE including visual weld inspection, quality assurance, quality control in accordance with codes, specifications, other standards, and/or drawings.

- 1 day will be totally dedicated to discussion & review of parts – 3 and 4.

### Part #3 – Welding Related Disciplines (Essay Exam)

**NDE/Weld Discontinuities:** ▪ NDE processes (radiographic, ultrasonic, magnetic particle, liquid penetrant, Eddy Current, etc.—characteristics, advantages and limitations) ▪ NDE symbols

**Welding Heat Sources and Arc Physics:** ▪ Power Source Static and Dynamic Characteristics (open circuit voltage and short circuiting current, slope) ▪ Differences Between CC And CV Designs (principle of self- adjusting) ▪ Welding Arc Characteristics (current and voltage relationship, arc length effect) ▪ Electron Emission (ionization potential, work function, electrode material, shielding gas and arc stability) ▪ Arc Temperature and Degree of Ionization (shielding gas influence) ▪ Magnetic Arc Blow (work lead location and condition) ▪ Lorentz Force (effect on droplet detachment and on adjacent power cables) ▪ Shielding Gas Drag Force (effect on droplet detachment and metal transfer mode) weld penetration and width for different shielding gases.

**Welding Processes and Controls:** ▪ Arc Welding Processes (SMAW, GMAW, FCAW, GTAW, SAW, PAW) ▪ Resistance Welding Processes (RW, high frequency RW), high energy density welding processes (LBW, EBW) ▪ Cutting Processes (OFC, CAC, and PAC) ▪ Surfacing Processing (SW, THSP) ▪ Solid-State Welding Processes (FRW, FW)

**Welding and Joining Metallurgy:** ▪ Crystal Structure of Metals (FCC, BCC, HCP, unit cells, lattice parameter, c/a ratio, atom positions, interstitial positions) ▪ Melting and Solidification, Phase Transformations and Phase Diagrams (eutectic, eutectoid, peritectic and monotectic, lever rule calculation) metallurgy and weldability of typical engineering materials (low carbon structural steels, cast irons, stainless steels, nickel alloys, aluminum alloys, titanium alloys, etc.) microstructure (e.g., ferrous alloys—grain boundary ferrite, acicular ferrite, bainite, martensite, austenite, delta ferrite, etc.) and mechanical properties ▪ Carbon Equivalent (CEI<sub>W</sub>, P<sub>cm</sub>, expressions, alloying content and carbon content effect) ▪ Hydrogen Assisted Cracking (heat-affected zone cracking, cold cracking) base metal matching (e.g., electrodes with high strength steels) ▪ Solidification cracking (segregation of impurity atoms, shrinkage cracking, lamellar tearing) ▪ Delta Ferrite in Stainless Consumables, Specifications for Consumables (categories; all position, rutile, basic) ▪ Flux metal Reactions (oxygen and sulfur control in weld pool) ▪ Typical Temperature Range of a Heat Source ▪ Temperature Distribution in a Weldment ▪ HAZ Formation ▪ Multi pass Thermal Experience, Reheated Weld Metal Properties ▪ Weld Macro and Micro-Graph Interpretation ▪ Solidification Profile and Preferred Grain Orientation (epitaxial growth) ▪ Origin of Weld Ripples ▪ Special Attributes of Base Metal (as-cast structure, deformation texture and oxide on flame cut surfaces) ▪ Thermal Treatments (preheat, post heat, inter pass influence on weld cooling rate and residual stress distribution) ▪ Solid-State Transformations in Welds (different forms of ferrite, bainite, and martensite, sigma phase in stainless steels, Guinier-Preston type precipitates zones and ageing in aluminum alloys) ▪ Corrosion (sensitization in stainless steel welds and stress corrosion cracking in welds)

**Weld Design:** ▪ Structural fabrication requirements, sectional properties and stress gradient ▪ Stress triaxiality, weld symbols, hardness and microhardness (e.g., across a weld cross section) ▪ Tensile properties, ductility, toughness, fillet break test (influence of second phase and porosity), ductile fracture, brittle fracture, fatigue (initiation, propagation, failure, high-cycle, low-cycle), temperature and strain rate effect.

**Brazing and Soldering:** ▪ Characteristics of Brazing and Soldering ▪ Fluxes and Substrates ▪ Capillary Action ▪ Wetting and Spreading ▪ Contact Angle ▪ Joint Clearance ▪ Viscosity ▪ Liquidus and Solidus ▪ Flow of Molten Filler in Horizontal and Vertical Joints (Maximum Penetration and Rate) ▪ Filler Metal Systems (Sn-Pb solders, Ni and Cu based alloys, Ag-Cu based brazing alloys) ▪ Intermetallic Compound Formation

**Safety:** ▪ Recognize health hazards relating to welding (fumes, toxic gases, noise and radiation) ▪ Recognize safety hazards (electric shock, compressed gases, fire, welding in a confined space, welding on Containers, piping and moving equipment) ▪ Recognize precautions to avoid injury ▪ Possess a working knowledge of safety and fire codes

### Part #4 – Practical Welding and Related Applications

**Exam using references on the application of welding engineering concepts in the areas of:**

Welding safety, Weldment design, Welding Metallurgy, Materials, Welding Process Selection, NDE including Visual Weld Inspection, Quality Assurance, Quality Control in Accordance With Codes, Specifications, other Standards, and /or Drawings.