Advanced Steel Design

Module I: Introduction to Structural Forms and Failure Analysis

Geometric forms of engineering structures, Loads on marine and industrial structures, Failure analysis of members in 2D and 3D stress states, Comparison of failure theories (Maximum stress, von Mises, Tresca), Material properties of structural steel under normal and high temperature, Design methods and code compliance (overview)

Module II: Plastic Behaviour and Design

Plastic behaviour of structural members, Shape factor and plastic hinges, moment–curvature relationships, Upper and lower bound theorems, Estimation of collapse loads, Principles of plastic design

Module III: Stability Analysis of Members and Frames

Beam-column behaviour under axial tension and compression, Beam-columns with elastic supports, Stability analysis of frames using stiffness approach, Stability functions and formulation, MATLAB-based stability analysis.

Module IV: Unsymmetric Bending and Curved Beams

Theory of unsymmetric bending, curved beams with small and large initial curvature, Applications: Crane hooks and structural details, Computational modelling with MATLAB.

Module V: Column Buckling and Code-based Design

Column design phenomena, Lateral buckling and torsional buckling, Use of stiffeners in marine structures, Beam-column design considerations, Lateral and torsional buckling of open sections, Examples and comparisons using Eurocode, Australian Code, and Indian Standards.

Module VI: Extreme and Accidental Loads

Blast load effects on structures, Impact loads and ship-structure interaction, Ice-infested loading on offshore and marine structures, Fire loads and thermal effects, Principles of fire-resistant design

Module VII: Case Studies and Design Applications

Design examples of large industrial structures, Offshore production steel platforms: design and analysis, Postulated analysis of nuclear power plant structural elements, Integration of code provisions in practical design