

Course Number: EN 513

Course Name: Life Extension Engineering

Credits: 3-0-0-3

Prerequisites:

Intended for: UG/PG

Semester: Odd/Even

Preamble: The course will provide an introduction to safety of structures and the challenges in using aging structures beyond the original design life. The course is related to structures in general, but with emphasis on offshore structures. The course will include the required evaluations and analyses, and how one should manage structures in a life extension period.

Course Outline: Purchasing, fabricating, maintaining and repairing equipment at the lowest possible cost while assuring non-failure is always a priority. The causes of damage and failure of piping, vessels, and tanks will be described throughout the course as well as how to prevent these incidents. The risk-based inspection planning process and inspection techniques for operating equipment are discussed.

Course Modules:

Module 1

Inspection, monitoring and materials degradation, Structural integrity assessment (input parameters and assessment method) and life prediction, Risk assessment, life extension and economics. (10)

Module 2

Life prediction for boiler components: Materials and damage mechanism, boiler tube failure mechanism, Header-damage mechanism, Damage mechanism in steam pipes, Damage and life assessment of boiler component, Extrapolation of statistics of part failures, Methods based on temperature estimation, Integrated methodology for life assessments.

Life assessment for steam-turbine components: Materials and damage mechanism, Service failure experience, Remaining life assessment: methods for rotors, Remaining life assessment of valves and steam chests, Remaining-life analysis of blades, Remaining-life assessment of bolts. (12)

Module 3

Life assessment techniques for combustion-turbines: Life assessment techniques, Crack initiation assessment, Crack-propagation analysis for vanes, Crack tolerance of blades, Integrated methodology for life assessment. (8)

Module 4

Service life, reliability and maintenance of structures: Structural reliability and service life Time-dependent reliability and service life. Probabilistic methods for service life estimation of engineering structures. (6)

Module 5

Pipeline rehabilitation systems for service life extension: Extending service life ,Trenchless renewal methods (TRMs), Selection of renewal method , Current design concepts for pipeline renewals , Emerging design concepts for pipeline renewal systems, Long-term testing. (6)

References:

1. Viswanathan, Ramaswamy. Damage mechanisms and life assessment of high temperature components.ASM international, 1989.
2. Proceedings of the Third International Conference on Engineering Structural Integrity Assessment organised by The Dynamic Testing Agency in conjunction with AEA Technology, held at Churchill College, Cambridge, U.K., September 24-26, 1996 Editors: J.H.Edwards, P.E.J. Flewitt, B.C. Gasper, K.A. McLarty, P. Stanley and B. Tomkins. ISBN 0 947817 89 1 (1996), 756 pages.
3. Karbhari, Vistasp M., and Luke S. Lee, 1st eds. Service life estimation and extension of civil engineering structures. Woodhead Publishing Limited, Elsevier, 2010.