



FAILURE ANALYSIS AND PREVENTION

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INTENDED AUDIENCE : UG and PG Student, Research Scholar & Practicing Engineers

INDUSTRIES APPLICABLE TO : Heavy engineering and pressure vessel industry, power plants

COURSE OUTLINE :

The course content is designed to systematic understanding on various aspects related with failure such as fundamental sources of failure of mechanical components, industrial engineering tools relevant to failure and failure analysis, general procedure of failure analysis through sample collection, preparation and preservation, testing, macro and microscopic observation of fracture, mode of fracture, metallographic procedure and image analysis, use of fracture mechanics and fracture toughness principles in failure analysis and analysis findings and report/recommendation writing. Presentation will include case studies to communicate concepts and procedures effectively. Case studies will be taken up from failure analysis of weld joints in different sectors.

ABOUT INSTRUCTOR :

Prof. D K Dwivedi obtained BE (mechanical engineering), in 1993 from GEC Rewa, ME (welding engineering) from Univ. of Roorkee in 1997 and PhD in Met. Engineering from MNIT, Jaipur in 2003. He has about 9 years teaching experience at NIT Hamirpur and 14 years at IIT Roorkee in subjects related with manufacturing at UG level and welding engineering related subjects at PG level. He has published more than 120 research papers in SCI/SCIE indexed journals and undertaken 20 sponsored research and 50 industrial consultancy projects. He has authored two books entitled Production and Properties of Cast Al-Si Alloys with New Age International, New Delhi (2013) and Surface Engineering with Springer, New Delhi (2018).

COURSE PLAN :

Week1:

1. Introduction: Need and scope of failure analysis and prevention
2. Introduction: Engineering disasters and understanding failures
3. Fundamental sources of failures: Deficient design I
4. Fundamental sources of failures: Deficient design II
5. Fundamentalsources of failures: Deficient design III and upgrading of a part

Week2:

1. Fundamental sources of failures: Imperfections in base metals
2. Fundamental sources of failures: Improper Manufacturing I
3. Fundamental sources of failures: Improper Manufacturing II
4. Fundamental sources of failures: Improper Manufacturing III
5. Fundamental sources of failures: Improper Manufacturing IV and improper service conditions

Week3:

1. Fundamental sources of failures: Poor assembly, service and maintenance
2. Industrial engineering tools for failure analysis: Pareto diagram
3. Industrial engineering tools for failure analysis: Fishbone diagram and FMEA
4. Industrial engineering tools for failure analysis: FMEA
5. Industrial engineering tools for failure analysis: Fault tree analysis

Week4:

1. Industrial engineering tools for failure analysis: Reliability-I
2. Industrial engineering tools for failure analysis: Reliability-II
3. General procedure of failure analysis: Steps
4. General procedure of failure analysis: Background information collection
5. General procedure of failure analysis: Preliminary examination

Week5:

1. General procedure of failure analysis: NDT for failure analysis
2. General procedure of failure analysis: Destructive testing
3. General procedure of failure analysis: DT, selection, preservation, cleaning & sectioning of samples
4. General procedure of failure analysis: Macroscopy of fracture surfaces-I
5. General procedure of failure analysis: Macroscopy of fracture surfaces-II

Week6:

1. General procedure of failure analysis: Macroscopy of fracture surfaces-III
2. General procedure of failure analysis: Macroscopy of fracture surfaces-IV
3. General procedure of failure analysis: Microscopy of fracture surfaces
4. General procedure of failure analysis: Metallography of failed components
5. General procedure of failure analysis: Determination of type of fracture I

Week7:

1. General procedure of failure analysis: Determination of type of fracture II
2. General procedure of failure analysis: Determination of type of fracture III and chemical analysis
3. General procedure of failure analysis: Application of fracture mechanics I
4. General procedure of failure analysis: Application of fracture mechanics II
5. General procedure of failure analysis: Simulated test and analysis of evidences/results

Week8:

1. General procedure of failure analysis: Questions for analysis
2. General procedure of failure analysis: Reporting failure analysis and failure analysis of welded joint
3. General procedure of failure analysis: Failure analysis of weld joint
4. General procedure of failure analysis: Examples of failure analysis
5. General procedure of failure analysis: Embrittlement of steels