FAILURE ANALYSIS AND DESIGN

(Elective – II)

Course Code:15ME2210

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Course Outcomes:

At the end of the course, the student will be able to

CO1: analyze the role of models in design.

CO2: analysis of the elastic plastic fracture mechanics.

CO3: provide solutions for the prediction of fatigue life of finite and infinite problems.

CO4: explain significance of the creep and growth in fatigue.

CO5: explain the role of different wears in fracture mechanics.

UNIT- I (10-Lectures)

Introduction, role of failure prevention analysis in mechanical design, definition of design, challenge, some design objectives, definition of failure mode, failure modes observed in practice, glossary of mechanical failure modes

Introduction to fracture mechanics, an introduction to linear elastic fracture mechanics, use of fracture mechanics design, elastic-plastic fracture mechanics.

UNIT – II (10-Lectures)

Introduction, historical remarks, nature of fatigue, fatigue loading, laboratory fatigue testing, S-N-P curves, factors that affect S-N-P curves using the factors in design, influence of non zero mean stress multi axial fatigue stresses using multi axial fatigue failure theories.

Introduction, linear damage theory, cumulative damage theories, life prediction based on local stress-strain and fracture mechanics concepts, service loading simulation and full scale fatigue testing, damage tolerance and fracture control.

UNIT – III (10-Lectures)

Introduction, strain cycling concept, strain life curve and low cycle fatigue relationships, influence of non zero mean strain and non zero mean stress ,cumulative damage rule in low cycle fatigue.

UNIT – IV (10-Lectures)

Introduction, prediction of long term creep behaviour, theories for predicting creep behaviour, creep under uniaxial state of stress and multi axial state of stress, cumulative creep concept, combined creep and fatigue.

UNIT – V (10-Lectures)

Introduction, variables of importance in the fretting process, fretting fatigue, fretting wear, fretting corrosion, minimising or preventing fretting damage.

Introduction, wear-adhesive, abrasive, corrosion, surface fatigue, deformation, fretting impact, empirical model of zero linear, corrosion, stress corrosion cracking.

TEXT BOOK:

Jack A.Collins, "*Failure of Materials in Mechanical Design*", 2nd edition, Wiley Inter science Publishers, 2013.

REFERENCES BOOKS:

1. Preshant Kumar, "*Elements of Fracture Mechanics*", Wheeler Publishing, 1999.
2. David Broek, Fifthoff and Noerdhoff, "*Elementary Engineering Fracture Mechanics*", 4th edition, Springer Publishers, 2013.