SCHEME OF COURSE WORK

Course Details:

Course Title	**: Failure Analysis and Design**		
Course Code	**:** 13ME2211	**L P C**	**:4 0 3**
Program:	**: M.Tech.**		
Specialization:	**: CAAD**		
Semester	**: II**		
Prerequisites	**:--**		
Courses to which it is a prerequisite	**:--Design of Machine Members**		

Course Outcomes (COs):

The student will be able to

CO1	Analyze the role of models in design
CO2	Analysis of the elastic plastic fracture mechanics
CO3	Select 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

Program Outcomes (POs):

At the end of the program, the students in CAAD will be able to

PO 1	acquire knowledge in latest computer-aided design and analysis tools
PO 2	create 3D models of real-time components using latest CAD software
PO 3	acquire technical skills to formulate and solve engineering and industrial problems
PO 4	carry out analysis for the design of new products
PO 5	have proficiency to solve problems using modern engineering design tools
PO 6	have capability to work in multidisciplinary streams
PO 7	apply project and finance management skills to organise engineering projects
PO 8	prepare technical reports and present them effectively
PO 9	engage in lifelong learning
PO 10	realize professional and ethical responsibilities
PO 11	conduct surveys, analyse data, plan, design and implement new ideas into action

Course Outcome Versus **Program Outcomes:**

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO-1	S			M							
CO-2		S		S	S						
CO-3			S	M							
CO-4			S	M	S						
CO-5					S	M					

S - Strongly correlated, M - Moderately correlated, Blank - No correlation

Assessment Methods

Assessment Methods:	Assignment / Quiz / Seminar / Case Study / Mid-Test / End Exam

1. Teaching-Learning and Evaluation

Week	Topic / Contents	Course Outcomes	Sample questions	Teaching-Learning Strategy	Assessment Method & Schedule
1	Introduction, role of failure prevention analysis in mechanical design, definition of design, some design objectives	CO-1	1.What is the role of failure prevention in mechanical design? 2. Explain the design objectives 3.What are the various failure modes? 4.What do you mean by linear elastic fracture mechanics?	Lecture Demonstration	Assignment - I (Week 2 - 4)
2	Definition of failure mode, failure mode observed in practice, glossary of mechanical failure modes	CO-1			
3	Introduction to fracture mechanics and linear elastic fracture mechanics	CO-1			
4	Use of fracture mechanics design, elastic-plastic fracture mechanics	CO-1			
5	Introduction, historical remarks, nature of fatigue, fatigue loading, laboratory fatigue testing, S-N-P curves	CO-2	1. What are the effects of fatigue loading? 2. Explain the effect of S-N-P curves using the factors in design. 3. What is the influence of non zero mean stress using multi axial fatigue failure theories? 4.What are the cumulative damage theories?	Lecture Problem solving	Seminar - I (Week 6 - 8)
6	Factors that effect S-N-P curves using the factors in design, influence of nonzero mean stress multi axial fatigue stresses using multi axial fatigue failure theories	CO-2			
7	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	CO-2			
8	Introduction, strain cycling concept, strain life curve and low cycle fatigue relationships	CO-3			
9	Mid-Test 1	CO-1, CO-2			Mid-Test 1 (Week 9)

10	Influence of nonzero mean strain and non zero mean stress	CO-3	1.Explain the concept of strain cycling. 2. What is the influence of non zero mean strain and nonzero mean stress in the fracture mechanics?	Lecture Discussion	Assignment - II (Wee12 - 14)
11	Cumulative damage role in low cycle fatigue	CO-3			
12	Introduction, prediction of long term creep behaviour	CO-4			
13	Theories for predicting creep behavior, creep under uniaxial state of stress and multi axial state of stress	CO-4	1.Explain the theories for predicting creep behaviour 2.What is the creep behavior under uniaxial and multi axial state of stresses? 3.Explain the concept of combined creep and fatigue.	Lecture Discussion Problem solving	Seminar - II (Week 16 - 18)
14	Cumulative creep concept, combined creep and fatigue	CO-4			
15	Introduction, variables of importance in the fretting process, fretting fatigue	CO-5	1.Explain the role of different wears in fracture mechanics. 2.How do you prevent the fretting damage? 3.What do you mean by surface fatigue?	Lecture Problem solving	
16	Fretting wear, fretting corrosion, minimizing or preventing fretting damage	CO-5			
17	Introduction, wear –adhesive, abraisive, corrosion, surface fatigue, deformation, fretting impact, empirical model of zero linear, corrosion, stress corrosion cracking	CO-5			
18	Mid-Test 2	CO-3, CO-4, CO-5			Mid-Test 2 (Week 18)
19/ 20	END EXAM	All Cos			