CREEP FATIGUE AND FRACTURE

CourseCode	20ME6602	Year	III	Semester	II
Course Category	HONORS	Branch	ME	Course Type	Theory
Credits	4	L – T – P	3 – 1 – 0	Prerequisites	Material Science and Metallurgy
Continuous Internal Evaluation	30	Semester End Evaluation	70	Total Marks	100

Course Outcomes: Upon successful completion of the course, the student will be able to

	Statement	Skill	BTL	Units
CO1	Understand the behaviour of material under creep, fatigue and fracture loading.	Understand	L2	1,2,3,4,5
CO2	Analyse the time dependent behaviour of materials and related mechanisms.	Analyse	L4	1,2
CO3	Analyse the fatigue behaviour of materials under different loading conditions and the feature of fatigue by considering size, surface and stress concentration	Analyse	L4	3,4
CO4	Analyse the fracture modes and parameters	Analyse	L4	5

Contribution of Course Outcomes towards achievement of Program Outcomes & Strength of correlations (3:High, 2: Medium, 1:Low)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2						2		2	3	1
CO2	3	3	2	2						2		2	3	1
CO3	3	3	2	2						2		2	3	1
CO4	3	3	2	2						2		2	3	1

Syllabus

UNIT	Contents	Mapped COs
I	Creep and Stress Rupture, high Temperature Materials Problems, Time dependant Mechanical Behavior, The creep curve, the stress rupture test, structural changes during creep	**CO1, CO2**
II	Mechanism of creep deformation, deformation mechanism Maps, Activation Energy for steady state creep, super plasticity, High Temperature alloys, Prediction of long time properties, Creep under combined stresses, creep Fatigue Interaction	**CO1, CO2**
III	**Fatigue of Metals:** Introduction, Stress Cycles, The SN curve, Statistical Nature of Fatigue, Effect of mean stress on fatigue, Cyclic stress strain curve, Low cycle fatigue, strain life equation	**CO1, CO3**
IV	Structural features of fatigue, Fatigue crack propagation, Effect of stress concentrating on fatigue, size effect, surface effect and fatigue, fatigue under combine stresses, cumulative damage theories, Machine design approach-Infinite Life design, local strain approach	**CO1, CO3**
V	**Modes of fracture:** Mode I, II and III, Linear Elastic Fracture Mechanics (LEFM), Stress Intensity Factor(SIF), Stress field near the crack tip, Critical SIF and Fracture Toughness, Crack tip opening displacement,	**CO1, CO4**

	Strain Energy Release Rates (SERR), Elasto-Plastic Fracture Mechanics (EPFM), J-Integral Method.	

Learning Resources
Text books
1.Prashant Kumar, Elements of Fracture Mechanics by Tata McGraw-Hill. 2.George E. Dieter, Mechanical metallurgy, McGraw-Hill Publishing
Reference books
1. J. A. Collins, Failure of Materials in Mechanical Design: Analysis, Prediction, Prevention, 2/3, John Wiley & Sons, 1993