

## CREEP FATIGUE AND FRACTURE

<b>CourseCode</b>		<b>Year</b>		<b>Semester</b>	
<b>Course Category</b>	HONORS	<b>Branch</b>	ME	<b>Course Type</b>	Theory
<b>Credits</b>	3	<b>L – T – P</b>	3 – 0 – 0	<b>Prerequisites</b>	Material Science and Metallurgy
<b>Continuous Internal Evaluation</b>	30	<b>Semester End Evaluation</b>	70	<b>Total Marks</b>	100

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

	<b>Statement</b>	<b>Skill</b>	<b>BTL</b>	<b>Units</b>
<b>CO1</b>	Understand the behaviour of material under creep, fatigue and fracture loading.	Understand	L2	1,2,3,4,5
<b>CO2</b>	Analyse the time dependent behaviour of materials and related mechanisms.	Analyse	L4	1,2
<b>CO3</b>	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
<b>CO4</b>	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
<b>CO1</b>	3	3	2	2						2		2	3	1
<b>CO2</b>	3	3	2	2						2		2	3	1
<b>CO3</b>	3	3	2	2						2		2	3	1
<b>CO4</b>	3	3	2	2						2		2	3	1

**Syllabus**

<b>UNIT</b>	<b>Contents</b>	<b>Mapped COs</b>
<b>I</b>	Creep and Stress Rupture, high Temperature Materials Problems, Time dependant Mechanical Behavior, The creep curve, the stress rupture test, structural changes during creep	<b>CO1, CO2</b>
<b>II</b>	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	<b>CO1, CO2</b>
<b>III</b>	<b>Fatigue of Metals:</b> 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	<b>CO1, CO3</b>
<b>IV</b>	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	<b>CO1, CO3</b>
<b>V</b>	<b>Modes of fracture:</b> 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,	<b>CO1, CO4</b>

	Strain Energy Release Rates (SERR), Elasto-Plastic Fracture Mechanics (EPFM), J-Integral Method.	
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<b>Learning Resources</b>
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<b>Text books</b>
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1. [Prashant Kumar](#), Elements of Fracture Mechanics by Tata McGraw-Hill.
2. [George E. Dieter](#), Mechanical metallurgy, McGraw-Hill Publishing

<b>Reference books</b>
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1. J. A. Collins, Failure of Materials in Mechanical Design: Analysis, Prediction, Prevention, 2/3, John Wiley & Sons, 1993