Course Type	Course Code	NameofCourse	L	T	P	Credit
DE	NMED526	Mechanical Behaviour of Engineering Materials	3	0	0	3

CourseObjective
• This course deals with the fundamentals of mechanical behavior of Engineering of materials. Mechanical properties evaluation and testing techniques, types of loading, and respective failure modes. • The course attempts to capture the microstructure of mechanicalbehavior correlations in materials.
LearningOutcomes
Uponcompletionofthiscourse,students willbeableto • Able to understandelastic andplasticdeformation behaviourofmaterials • To know the different mechanical properties evaluation and testing technique • Analysis of Mechanical testing results • Explore the failure mechanism and its correlation with miscrostruture

Unit No.	TopicstobeCovered	Lecture Hours	LearningOutcome
1	Introduction, Origin of elasticity, Stress as a tensor, Transformation of stress, Principal stresses,Mohr's circle, Stress-strain relationships in isotropic and anisotropic materials	4	Students will be able to understand basic fundaments of stress, strain, and state of stress
2.	Tensile testing, Compression testing, Universal testing machines,Flow stress, Yield criterion: Tresca, von Mises, Effective stress, Effective strain	4	Studentswilllearndifferent mechanical monotonic properties evaluation and testing techniques.
3	Plastic instability, Effect of strain Rate and temperature, Dislocations: discovery and Fundamentals; Dislocations: characteristics, stress and strain fields of dislocations, Energy of dislocations, Dislocation motion: glide, Dislocation motion: Cross-slip and climb, steps in dislocations, slip systems, More on slip systems	6	Students will learn theory of plastic deformation through slip and twin.

4	Strengthening mechanisms: Precipitation strengthening: basic Criteria, precipitate characteristics, mechanisms, effect of temperature; Dispersion Strengthening; Solid solution strengthening: Interaction with dislocations, Yield point phenomenon; Grain boundary strengthening	6	Studentswilllearnvariousstrengtheningmechanismsinmetallicmaterials.
5.	Fracture of solids: Linear elastic stress field in cracked bodies, Crack deformation modes, Singular stress field, and displacement fields	5	Student will learn the basic fundamentals of fracture Mechanics
6.	Types of fracture in metals, the theoretical cohesive strength of metals, Griffith theory, stress field near the crack tip, stress intensity as a similitude parameter, the crack tip plastic zone: size and shape in plane stress vs. plain strain, fracture toughness, K1C, and J1C. Size requirements, the energy release rate, and R curve concept,	6	Students will learn the concept, Practical application and Fracture testing result analysis
7.	Fatigue of engineering materials: Characteristics of fatigue fracture -Fatigue crack propagations laws, Strain controlled fatigue, Stress controlled fatigue, and ratcheting fatigue	6	Students will learn failure of materialsunder cyclic loading conditions and willbeabletoestimatethelifeofthecomponent
8.	Creep: Introduction to creep, mechanisms of creep, Creep of pure metals, alloys, superalloys. Creep of ceramics and polymers, creep asymmetry.	5	Students will learn high-temperature mechanical properties.
	Total	42	

TextBooks:

1. Dieter,G.E.,"MechanicalMetallurgy",3rdEd., McGrawHill,NewYork,2013.
2. Courtney, T.H., "Mechanical Behavior of Materials", 2nd Ed., McGraw Hill, NewYork,2000.

ReferenceBooks:

1. Meyers,M.A.andChawla,K.K.,"MechanicalBehaviorofMaterials",PrenticeHall.
2. Hull,D.andBacon,D.J.,"IntroductiontoDislocations",PergamonPress, 2008
3. R.W. Hertzberg, Deformation and Fracture Mechanics of Engineering Materials, 5thEd.,JohnWiley,New York, 2012
4. W.F.Hosford,MechanicalBehaviorofMaterials,Cambridge UniversityPress,2005