

Gautam Buddha University; Greater Noida

School of Engineering (Mechanical Engineering)

Degree	Course Name	Course Code	Marks:100
M. Tech. in Design Engg.	Mechanical Behavior of Materials	MED 509	SM+MT+ET 25+25+50
Semester	Credits	L-T-P	Exam.
I	3	3-0-0	3 Hours

Unit – I

Introduction: Plastic Deformation and Dislocation Theory; Lattice defects; Deformation in a perfect lattice; Dislocation in crystal and deformation; Strain hardening of single crystal; Low angle grain boundaries; Yield point and strain ageing. Stress field of a dislocation; Forces between dislocations; Dislocation climb and jog; Interaction with vacancy and impurity. Multiplication of dislocation and pile-up. **(07 Hours)**

Unit – II

Material Properties: Behavior under Tension; Engineering and true stress-strain curves; Strength coefficient and strain hardening exponent; Necking or instability in tension; Effect of gauge length on strength and elongation; Effect of strain rate and temperature on tensile properties; Yield point phenomenon; Fracture under tension and torsion. **(06 Hours)**

Unit – III

Fatigue: Effects Fatigue of Metals; Stress cycle; Fatigue curve; Fatigue fracture characteristics; Fatigue testing and testing machines; Determination of fatigue strength. Factors affecting fatigue- size; Surface; Stress concentration; Superimposed static stress; Corrosion; Contact under pressure. Under stressing; Coaxing and overstressing; Effect of metallurgical impurities. **(08 Hours)**

Unit – IV

Creep of Metals; Creep strain and creep-time curves; Low temperature and high temperature creep theories; Fracture at elevated temperature; Stress rupture; Creep parameters and practical applications; Effect of metallurgical variables and materials for high temperature applications. **(07 Hours)**

Unit – V

Material Failure: Brittle failure and Behavior under Impact; The history of failure of engineering structures and parts; High strain rate; Stress concentration and low temperature effects; Impact tests and results; Transition temperature and factors affecting transition temperature; Flow and fracture under rapid loading; Temper and hydrogen embrittlement.

(09 Hours)

Unit – VI

Smart Materials- Study of Smart Materials and their integration into novel designs. Classification according to their Response and Stimuli ability. Effect of crystalline structures in the properties of piezoelectric materials; Magnetostrictive materials; Shape memory alloys. Electro rheological fluids; Magneto-rheological fluids. Application of smart materials into mechanics of structures; Passive and active vibration control and on the principles of actuators and sensors.

(08 Hours)

Recommended Books:

1. Mechanical Behavior Materials; Marc Andre Meyers; K.K. Chawla; PHI
2. Mechanical Metallurgy; GE Dieter; McGraw-Hill Book Co. Kogakusha Co. Ltd.