MECHANICAL BEHAVIOUR OF MATERIALS (PART – II)

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PRE-REQUISITES : A course related to nature and properties of materials

INTENDED AUDIENCE : Undergraduate Students and first year graduate students of following discipline: Materials Engineering, Mechanical Engineering, Metallurgical Engineering, Aerospace Engineering

INDUSTRY SUPPORT : Manufacturing Companies, Automobile companies

COURSE OUTLINE :

This course has a vast syllabus and hence it has been partitioned into two sections. At the end of both the sections of the course, students should be well conversant with theory of plasticity, theory of dislocations and its relation to various mechanical properties exhibited by various materials, viz. strength, fracture, fatigue and creep.

ABOUT INSTRUCTOR :

Prof. Shashank Shekhar is an associate professor at IIT Kanpur. He joined IITK in 2010 and has since taught manufacturing related courses to 2nd year, 3rd year as well as 4th year UG students. His research interest lies in thermomechanical processing, particularly severe plastic deformation using techniques like machining and constrained groove pressing.

Prof. SudhanshuShekhar Singhis an assistant professor at IIT Kanpur. He joined IITK in December, 2015. He has taught courses related to manufacturing and mechanical behavior of materials to UG/PG students. His research interestsare deformation behavior of materials at both large and small length scales, Laser processing of materials and Corrosion.

COURSE PLAN :

Week 1: Recap of Part I, Introduction to fracture mechanics, Stress concentration, Crack growth criteria, Mode of deformation

Week 2: Stress intensity factor, Plane stress and strainStress intensity factor, Tri-axiality in plane stress and strain, Crack-tip plasticity

Week 3: Size and shape of plastic zone, Fracture toughness and measurement, Classification of fracture and mechanisms

Week 4: Classification of fracture and mechanisms continued, Introduction to Fatigue, Few cases of fatigue failures, SN curve, High and low cycle fatigue, Representation of fatigue data,

Week 5: Fatigue crack propagation, Mechanisms of fatigue fracture, Fatigue crack closure, Fatigue design approaches

Week 6: Failure in composites (Interfaces, direct/indirect strengthening, Damage evolution in fiber reinforced/ particulate reinforced composites), Failure in Ceramics (Damage in ceramic matrix composites, Toughening mechanisms)

Week 7: Failure in ceramics continued, Failure in Polymers

Week 8: Creep: Testing, Mechanisms: Diffusional related, Dislocations related, Grain boundary sliding, Harper Dorn, Power Law, Deformation Mechanism Maps