

**INDIAN INSTITUTE OF TECHNOLOGY TIRUPATI**  
**PROFORMA FOR NEW COURSE**

1.	Title of the Course	Material Science and Engineering
2.	Course Number	ME2105
3.	Status of the Course	Core
4.	Structure of Credits	3-0-2-4
5.	Offered To	UG
6.	New Course/Modification to	New
7.	To be Offered by	Department of Mechanical Engineering
8.	To take effect from	July 2018
9.	Prerequisite	Nil
10.	Whether approved by the Department	Yes
11.	<b>Course Objective:</b> To familiarize the students with fundamentals of materials science such as crystallography, principles of alloy formation, plastic deformation, mechanical properties, various types of heat treatment processes, isothermal transformation and continuous cooling transformation diagrams. Further to introduce Ceramic, Composite and Polymeric Materials.	
12.	<b>Course Content:</b> Introduction to crystallography: Crystal structure - atomic bonding, unit cells and crystal systems, metallic crystal structures, imperfections in solids; Principles of alloy formation: solid solution, Hume-Rothery rules, binary phase diagrams, development of microstructure under equilibrium cooling and effects of non-equilibrium cooling, Iron-Iron carbide phase diagram; Elastic and plastic deformation: slip systems, critical resolved shear stress, Frank-Read source, work hardening, dynamic recovery, strengthening mechanisms, recovery, recrystallization and grain growth, cold and hot working; Mechanical properties: hardness, tensile strength, ductility, resilience and toughness, impact strength, fatigue and creep; Heat treatment: types of heat treatment, isothermal transformation diagram and continuous cooling transformation diagram; Ceramic and composite materials, and their applications; Advanced materials and their applications. Lab component: Metallographic sample preparation, examination of the microstructure of ferrous samples, quantitative metallography and image analysis, and heat treatment of steels.	
13.	Text book(s): 1. Askeland D R, <i>The Science and Engineering of Materials</i> , 5th Edition, Thomson (2005). 2. Callister W D, <i>Materials Science and Engineering</i> , 2nd Edition, Wiley India (P) Ltd. (2014).	
14.	Reference(s): 1. Avner S H, <i>Introduction to Physical Metallurgy</i> , 2nd Edition, McGraw Hill Education (2017). 2. Kodgire V D, <i>Material Science and Metallurgy for Engineers</i> , 31st Edition, Everest Publishing House (2011). 3. Raghavan V, <i>Materials Science and engineering - A first Course</i> , 6th Edition, Prentice Hall India Learning (P) Ltd. (2015).	