

1.	Title of the course	Advanced Solidification Processes
2.	Course number	ME5XXX
3.	Status of the course	Elective
4.	Structure of credits	3-0-0-3
5.	Offered to	PG
6.	New course/modification to	New
7.	To be offered by	Department of Mechanical Engineering
8.	To take effect from	July 2021
9.	Prerequisite	CoT
10.	Whether approved by the Department	Yes
11.	Course Objective(s): To present a logical progression of the essential elements of materials science relevant to molten phases and processes leading to their crystallization. To integrate the aspects of solidification and crystal growth.	
12.	Course Content: Introduction and advances in metal casting processes; Crystals and melts; Thermodynamics of crystal-melt phase change; Solidification of pure materials; Macro-scale phenomena; Macro-segregation; Plane front solidification; Composition control; Crystal melt interfaces; Constitutional supercooling; Linear morphological stability; Non-linear stability models; Nucleation catalysis; Microstructure evolution; Dendritic growth; Micro-segregation; Interface structure and growth kinetics; Polyphase solidification; Rapid solidification; Casting defects, properties and simulations; Foundry industry tour and experiments.	
13.	Textbook(s): 1. Fleming M C , <i>Solidification Processing</i> , 1st Edition, McGraw-Hill Book Company, New York (1974). 2. Stefanescu D M, <i>Science and Engineering of Casting Solidification</i> , 2nd Edition, Kluwer Academic Publishers (2009).	
14.	Reference(s): 1. Campbell J, <i>Complete Casting Handbook: Metal Casting Processes, Techniques and Design</i> , 1st Edition, Butterworth-Heinemann (2011). 2. Kurz W and Fisher D J, <i>Fundamentals of Solidification</i> , Trans Tech Publications (1998). 3. Minkoff I, <i>Solidification and Cast Structure</i> , John Wiley & Sons (1986). 4. Tuttle R B, <i>Foundry Engineering: The Metallurgy and Design of Castings</i> , Createspace Independent Pub (2012).	