MATERIALS FOR ADVANCED APPLICATIONS (3-0–0)

Module – I (14 hours)

Introduction: The urge for advancement in materials development and processing, Special and high temperature alloys: Ti alloys: physical and mechanical properties, thermo-mechanical treatment of Ti-alloys, Ti shape memory alloys, Fe based super alloys, Ni based alloys, Co based alloys, engineering applications at elevated temperatures.

Metallic Foams: Material Definition and Processing, Characterization of cellular metals, Material properties and applications.

Module – II (12 hours)

Carbon and alloy steels: high strength low alloy structural steels, medium-high carbon ferrite-pearlite steels, common alloy steels, Tool steels: classification, composition, structure, properties, heat treatment and uses of different types of tool steels, Special steels: heat resisting steels, Hadfield manganese steels, TRIP steels, maraging steels, dual phase steels.

Module –III (12 hours)

Composite Materials: Material definition and classifications, Advanced polymer composite, Ceramic composite, Metal matrix composite, Nanocomposite, Applications. Coatings and thin films: Definition, Classification of applications, Bio-Materials: Various types of biomaterials, Biopolymer, Bioceramics, Nanostructured bio-materials, Classes of materials used in medicine, Application of materials in medicine and dentistry, Various materials and coatings for implants.

Books for reference:

1. Engineering Materials – properties and selection by K.G. Budinski and M.K. Budinski, PHI.
2. Intermetallic Compounds, Volume 1- 4, by J. H. Westbrook (Editor), R. L. Fleischer (Editor), Wiley.
3. Structure-Property Relations in Nonferrous Metals by Alan Russell, Kok Loong Lee, Wiley.
4. Physical Metallurgy Principles by R. E. Reed-Hill
5. Structure and Properties of Alloys by R. M. Brick, R. B. Gordon and A. Phillips
6. Introduction to Materials Science and Engineering by J. F. Shackelford.
7. Physical Metallurgy of Steels by W.C.Leslie, McGraw-Hill.
8. Introduction to Physical Metallurgy by S.H.Avener, McGraw-Hill.
9. Introduction to Material Science and Engineering by Callister, Wiley.
10. Edited by B.D. Ratner, A.S. Hoffman, F.J. Sckoen, and J.E.L Emons, *Biomaterials Science, An Introduction to Materials in Medicine*, Academic Press, Second edition, 2004.