BMPC3005 BIOMATERIALS AND TISSUE ENGINEERING (3-0-0)

Module I

Introduction to biomaterials, Types of biomaterials, Biocompatibility testing of biomaterials, Surface characterization methods, Cells interaction with biomaterials.

Module II

Scaffold fabrication methods: fiber bonding, electrospinning, solvent casting, and particulate leaching, melt molding, freeze drying, phase separation, Rapid prototyping. Micro and nano fabricated Scaffolds. Three dimensional scaffolds- Design and engineering, Smart biomaterial.

Module III

Biocomposite: Introduction, biocompatibililty, fabrication(filament winding, pultrusion, extrusion, injection molding, compression molding, thermoforming) and characterization, mechanics of composite materials, structure-property relationship, designing with composite materials, Biomedical application of polymer composites- bone plates, intramedullary nails, total hip replacement, bonegrafts, denatsl materials, prosthetic sockets, tendons and ligaments, vascular grafts.

Module IV

Bioceramics: bio-ceramics as implant in human body, Physics of bone and structure of tooth, Cortical bone versus Trabecular bone structure. Bio-glass and A/W Glass ceramics, Hydroxyapatite, Bioactivity and bone bonding, porous hydroxyapatite and study of bio compatibility; Composite implant materials: mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement. Polymers filled with osteogenic fillers. Host tissue reactions;

Module V

Properties of biomaterials: Bulk properties – mechanical, biological and chemical properties; Surface properties – Surface roughness and surface characterization. Testing of biomaterials/Implants: In vitro testing (Mechanical testing): tensile, compression, wears, fatigue, corrosion studies and fracture toughness. In-vivo testing (animals): biological performance of implants. Ex-vivo testing: in vitro testing simulating the in vivo conditions.

Books

1. J. A. Burdick Biomaterials for Tissue Engineering Applications Springer Verlag2010 ISBN: 3709103843
2. L. L. Hench and J. R. Jones, Biomaterials, Artificial Organs and Tissue Engineering, Taylor & Francis 2007
3. J. F. Shackelford, Advanced Ceramics (vol. 1) Bioceramics, Gordon and Breach Science Publishers, New York, 1999.
4. S. H. Teoh, Engineering Materials for Biomedical Applications, World ScientificEdition1, 2004.
5. S. Ramakrishna, An Introduction to Biocomposites, Imperial College Press; Edition 1, 2004 Page46