



Approved in 44th BoA Meeting (24-11-2021)

Course number	: BE504
Course Name	: Biomaterials
Credit Distribution	: 3-0-2-4
Intended for	: B. Tech-M. Tech. Integrated Dual Degree Bioengineering, Core for IDD BE and elective for others
Prerequisite	: IC 136 Understanding Biotechnology and its Applications and IC 241 Materials Science for Engineers or Consent of Faculty Member
Mutual Exclusion	: NA

1. Preamble: The objective of this course is to build a solid foundation of knowledge for biomaterial science and technology. The target is to teach the physical and biological principles that serve as the scientific basis for understanding the interactions of biological molecules and cells with biomaterials employed for different biomedical applications.

2. Course Modules with quantitative lecture hours:

Module 1: Introduction to Biomaterials(8 hours)

Introduction to biomaterials and its history, Properties of Biomaterials- physico-chemical, mechanical, biocompatibility and biodegradability, Surface properties of biomaterials, Biological responses and Cell-Biomaterial interaction

Module 2: Classes of Biomaterials (8 hours)

Polymeric materials and blends, Biopolymers and hydrogels, Metal based biomaterials, Ceramics and bioglasses; Adhesive and sealants, Elastomers

Module 3: Biomaterials Applications (20 Hours)

Applications of biomaterials in cardiology, nephrology, ophthalmology, dentistry and orthopaedics; Wound healing and dressing materials, skin substitutes and sutures, Applications of Biomaterials in Functional Tissue Engineering and drug delivery systems

Module 4: Device development, Standards and regulatory compliance (6 Hours)

Biomaterial device development and Regulation, Voluntary consensus standards, Commercialization, corporate considerations, Ethical issues, Clinical trials, Entrepreneurship and post market considerations in biomaterials.

Lab component: (28 Hours)

Lab component of the course will include synthesis/fabrication, characterisation, biocompatibility testing and application of biomaterials. The experiments include.

- Preparation of polymeric nanosphere and characterization
- Drug/Protein loading and release study with polymeric nanospheres
- Preparation and characterization of hydrogels/nanosponges
- Preparation and characterization of electrospun nanofibrous mats
- Biocompatibility Testing
- Preparation of Bioceramics and its characterization

3. Text books:

1. Biomaterials Science (Third Edition), An Introduction to Materials in Medicine, ISBN 978-0-12-374626-9, Academic Press, Edited by: Buddy D. Ratner et al.

2. Bikramjit Basu; Biomaterials Science and Tissue Engineering: Principles and Methods; Cambridge University Press; [ISBN: 9781108415156]; 2017.

4. References:

1. Bikramjit Basu; Biomaterials for Musculoskeletal regeneration: Concepts; Springer Nature, 2017 [ISBN: 978-981-10-3059-8].

2. Advanced Biomaterials: Fundamentals, Processing and Applications; John Wiley & Sons, Inc., USA (ISBN: 978-0-470-19340-2), September, 2009.

3. Biomaterials Science and Biocompatibility, Fredrick H. Silver and David L. Christiansen, Piscataway, Springer, New Jersey.

4. Related journal articles

5. Similarity Content declaration with existing courses: NA

S. No.	Course Code	Similarity Content	Approx. % of Content
1.			

6. Justification of new course proposal if cumulative similarity content is >30%: