Introduction to Biomaterials - Video course

COURSE OUTLINE

Introduction to basic concepts of Materials Science; Salient properties of important material classes; Property requirement of biomaterials; Concept of biocompatibility; Structure and properties of biological cells & tissues; cell-material interactions and foreign body response; Assessment of biocompatibility of biomaterials, in vitro biochemical assays (cellular adhesion, cellular viability using MTT, osteogenic differentiation using ALP assay; Biomnuneralisation using Osteocalcin assay);

In vivo testing and histocompatibility assessment; genotoxicity assessment (Physical damage to DNA by biomaterial eluates); important biometallic alloys: Ti-based, stainless steels, Co-Cr-Mo alloys; Bioinert, Bioactive and bioresorbable ceramics; Processing and properties of different bioceramic materials with emphasize on hydroxyapatite; synthesis of biocompatible coatings on structural implant materials; plasma spraying of carbon nanotube reinforced hydroxyapatite on Ti-6Al-4V substrate; Microstructure and properties of glass-ceramics; biodegradable polymers; Design concept of developing new materials for bio-implant applications.

COURSE DETAIL

Sl. No	Topic	Lecture Numbers
1.	Introduction to basic concepts of Materials Science; Salient properties of important material classes	1-3
2.	Property requirement of biomaterials; Concept of biocompatibility	4-5
3.	Structure and properties of biological cells & tissues	6-7
4.	Cell-material interactions and foreign body response	8-10
5.	Assessment of biocompatibility of biomaterials	11
6.	In vitro biochemical assays (cellular adhesion, cellular viability using MTT, osteogenic differentiation using ALP assay; Biomnuneralisation using Osteocalcin assay)	12-15
7.	In vivo testing and histocompatibility assessment	16-17
8.	Genotoxicity assessment (Physical damage to DNA by biomaterial eluates)	18

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Metallurgy and Material Science

Additional Reading:

1. Biomaterials Science and Biocompatability, Fredrick H. Silver and David L. Christiansen, Piscataway, Springer, New Jersey.
2. Biological Performance of Materials: Fundamentals of Biocompatibility, Janathan Black, Marcel Dekker, Inc., New York and Basel, 1981.
3. Basic Cell Culture: A Practical Approach, Edited by J.M. Davis, IRL Press, Oxford University Pres, New York, 1994.

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9.	Important biometallic alloys: Ti-based, stainless steels, Co-Cr-Mo alloys	19-21
10.	Bioinert, Bioactive and bioresorbable ceramics	22-24
11.	Processing and properties of different bioceramic materials with emphasize on hydroxyapatite	25-27
12.	Synthesis of biocompatible coatings on structural implant materials	28-29
13.	Plasma spraying of carbon nanotube reinforced hydroxyapatite on Ti-6Al-4V substrate; in-vitro cytocompatibility	30-32
14.	Microstructure and properties of glass-ceramics	33-34
15.	Biodegradable polymers	35-37
16.	Design concept of developing new materials for bio-implant applications	38-40

References:

1. Biomaterials Science: An introduction to Materials in Medicine, Edited by Ratner, Hoffman, Schoet and Lemons, Second Edition: Elsevier Academic Press, 2004.
2. Comprehensive structural interity, Vol.9: Bioengineering Editors: Mithe, Ritchie and Karihalo, Elsevier Academic Press, 2003.