

Syllabus Biomaterials

First Course

Biomedical Engineering

Lecture - 1

- Introduction & Definition of biomaterials

Lecture - 2

- Structure of Solids (Atomic bonding & Crystal Structure)

Lecture - 3

- Structure of Solids (Atoms of Different Size & Imperfections in crystalline)

Lecture - 4

- Polymers (Long-chain molecules compounds & supercooled and network solids)

Lecture - 5

- Characterization of materials – I (Introduction & Mechanical properties)

Lecture - 6

- Characterization of materials – I (Mechanical Failure)

Lecture - 7

- Characterization of materials – I (Static failure, Dynamic fatigue failure & Friction and wear failure)

Lecture - 8

- Viscoelasticity & Thermal properties

Lecture - 9

- Phase diagram

Lecture - 10

- Strengthening by heat treatments

Lecture - 11

- Metals
- Ceramics and Glasses
- Polymers and Elastomers

Lecture - 12

- Surface properties and Adhesion

Lecture - 13

- characterization of materials – II (Electrical properties, Density and porosity) & (Examples)

Second Course

Biomedical Engineering

Lecture - 1

- Characterization of materials – II (Optical properties, X-ray absorption & Acoustic and ultrasonic properties)

Lecture - 2

- Metallic Implant Materials (Stainless steel, Types and Composition of Stainless Steels, Properties of Stainless Steel & Example)

Lecture - 3

- Metallic Implant Materials (Co-Based Alloys, Types and Composition of Co-Based Alloys, Properties of Co-Based Alloys & Example)
- Metallic Implant Materials (Ti and Ti-Based Alloys, Composition of Ti and Ti -Based Alloys & Structure and Properties of Ti and Ti -Based Alloys)

Lecture - 4

- Metallic Implant Materials (Dental Amalgam, Gold, Nickel-Titanium Alloys & Other metals)

Lecture - 5

- Metallic Implant Materials (Corrosion Metallic implants, Electrochemical Aspects, Pourbaix Diagrams in Corrosion, Rates of Corrosion and Polarization Curves & Example)

Lecture - 6

- Metallic Implant Materials (Corrosion of Available Metals & Minimization of Corrosion: Case Studies)

Lecture - 7

- Ceramic Implant Materials (Structure, Physical Properties, Aluminum Oxides, Zirconium Oxides, Calcium Phosphate, Glass-Ceramics, Carbons & Other Ceramics)

Lecture - 8

- Polymeric Implant Materials (Polymerization and Properties, Effect of Structural Modification and Temperature on Properties, Effect of Molecular Weight and Composition & Effect of Side-Chain Substitution, Crosslinking, and Branching)

Lecture - 9

- Polymeric Implant Materials (Polyamides (Nylons), Polyethylene, Polypropylene, Polyacrylates, Fluorocarbon Polymers & Rubbers)

Lecture - 10

- Polymeric Implant Materials. Deterioration of Polymers, Chemical Effects, Sterilization Effects, Mechanochemical Effects & In-Vivo Environmental Effects)

Lecture - 11

- Composites as Biomaterials (Structure, Applications of Composite Biomaterials, Dental Filling Composites and Cements & Porous Implants)