

**Learning Outcomes:**

The educational objectives of the course are to educate students to attain the following:

- To understand the basic types of materials used in human body
- To understand the importance of material selection in the implants
- The course contents will enable the students to study the effects of implants on human body required for Biomedical Engineers.
- The contents will allow the students to gain insight the designing of implants

**SYLLABUS**

Unit No.	Topics	Lectures (Hours)
	<b>Introduction to the overview and importance of the course. Commonly occurred problems in practice with various material and its processes should be discussed separately in each unit.</b>	
<b>1</b>	<b>INTRODUCTION OF BIOMATERIAL AND TYPES:</b> Definition and classification of bio-materials, mechanical properties, viscoelasticity, wound healing, process, body response to implants, Types: Ceramic, Polymer and metals.	<b>7</b>
<b>2</b>	<b>METALS AND CERAMICS:</b> Stainless steel, Titanium and titanium alloys, Cobalt based alloys, Nitinol. Dental metals-Gold, Nickel, Corrosion of the metals. <b>Ceramics-</b> Introduction to biomedical usages, Bio-active glass, High density alumina; Calcium phosphate ceramics- Porous materials, Biological interactions, Drug delivery from ceramics.	<b>6</b>
<b>3</b>	<b>POLYMERS:</b> Polymerization, Polyethylene, Prosthodontic polymers, Clinical study of soft polymers, Bioerodible polymers, Bioactive polymers, Hydrogels; Hard methacrylates. Drug incorporation polymer gels.	<b>6</b>
<b>4</b>	<b>CARDIAC AND OPHTHALMIC IMPLANTS:</b> Vascular grafts, heart valves, cardiac assisting devices, stent, implantable pacemaker. <b>Contact lenses:</b> Soft and hard lenses, Disposable lenses, Intra ocular lenses (IOLS), Viscoelastic solutions, Vitreous implants, Eye shields, Drainage tubes in Glucoma, Acrylic adhesives. General Manufacturing process of cardiac and ophthalmic implant.	<b>8</b>
<b>5</b>	<b>ORTHOPEDIC AND DENTAL IMPLANTS:</b> Temporary fixation devices, Fracture healing, Repair of the ligaments, Joint replacements; Total HIP replacement, Total knee replacements, Bone regeneration with resorbable material.	<b>7</b>

**Dental Implant modalities:** Dentures, Subperiosteal, Endosteal; Blade type, Root form, Packaging and preparation of dental implants. General Manufacturing process of orthopedic and dental implant.

**6 BIOCOMPATIBILITY AND STERILIZATION:**

**6**

Methods for testing and evaluating biocompatibility: In vitro testing, In Vivo Testing; Hemocompatibility, Osteocompatibility, Tissue reaction to external materials, Blood/biomaterial interaction, Treatment of materials for biocompatibility. Biodegradable materials and their applications, **Sterilization process:** ETO, gamma radiation, autoclaving. Effects of sterilization.

**Text Books:**

1. Sujata V. Bhatt, Biomaterials Second Edition, Narosa Publishing House, 2005.
2. JoonB.Park Joseph D. Bronzino, Biomaterials - Principles and Applications – CRC Press, 2003

**Reference Books:**

1. Fredrick H. Silver Chapman and Hall, Biomaterials Medical Devices and Tissue Engineering, London J.V. Park, Biomaterials Science and Engineering, Plenum Press, New York
2. Buddy D. Ratner, Allan S. Hoffman, Frederick j. Schoen, Jack E. Lemons, Biomaterials Science- An introduction to materials in medicine