

19BM214

BIOMATERIALS AND ARTIFICIAL ORGANS

Hours Per Week :

L	T	P	C
3	-	-	3

Total Hours :

L	T	P	WA/RA	SSH/HS	CS	SA	S	BS
45	-	-	10	9	-	6	3	2



SOURCE:

<https://>

hdnux.com/photos

PREREQUISITE COURSES: Engineering Physics, Engineering Chemistry, Biochemistry.

COURSE DESCRIPTION AND OBJECTIVES:

This course aims at imparting the knowledge of material science, chemistry and characteristics and classification of biomaterials. It is useful to learn about different metals and ceramics used as biomaterials, polymeric materials and combinations for mechanism of tissue replacement implants and also gives knowledge of the artificial organ development.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to achieve the following outcomes.

COs	Course Outcomes	POs
1	Identify the role of biomaterials in the field of biomedical engineering.	2
2	Apply recent trends of different biomaterials in drug delivery systems.	1
3	Comprehend the processes and challenges involved in implants and prosthesis using alloys.	2
4	Design various grafts for tissue repair and artificial organs.	3
5	Enumerate biomaterials for implants, soft and hard tissue replacements.	5

SKILLS:

- ✓ Understand the importance of biomaterials and implants in the healthcare.
- ✓ Study various materials for biocompatibility.
- ✓ Determine and selection of right materials for its bio applications.
- ✓ Apply specific design and quality control.

UNIT - I **L-9**

STRUCTURE OF BIO-MATERIALS AND BIO-COMPATIBILITY: Definition and classification of biomaterials, Mechanical properties, Viscoelasticity, Wound healing process, Body response to implants, Blood compatibility.

UNIT - II **L-9**

IMPLANT MATERIALS:IMPLANT MATERIALS: Metallic implant materials, Stainless steels, Co based alloys, Ti-based alloys, Ceramic implant materials, Aluminum oxides, Hydroxyapatite, Glass ceramics, Carbons, Medical applications.

UNIT - III **L-9**

POLYMERIC IMPLANT MATERIALS: Polymerization, Polyamides, Acrylic polymers, Rubbers, High strength thermoplastics, Medical applications, Biopolymers - collagen and elastin; Medical textiles silica, Chitosan, PLA composites, Sutures, Wound dressings; Materials for ophthalmology-contactlens, intraocular lens, membranes for plasma separation and blood oxygenation.

UNIT - IV **L-9**

TISSUE REPLACEMENT IMPLANTS: Small intestinal submucosa and other decellularized matrix biomaterials for tissue repair; Soft tissue replacements, Sutures, Surgical tapes, Adhesive, Percutaneous and skin implants, Maxillofacial augmentation, Vascular grafts, Hard tissue replacement Implants, Joint replacements, Pancreas replacement.

UNIT - V **L-9**

ARTIFICIAL ORGANS: Artificial blood, Artificial skin, Artificial heart, Prosthetic cardiac valves, Artificial lung (oxygenator), Artificial kidney (Dialyser membrane), Artificial pancreas, Dental implants.

TEXT BOOKS:

1. Joseph D. Bronzino, "The Biomedical Engineering Hand Book, 2nd Edition Boca Raton: CRC Press LLC, 2000.
2. Sujata V. Bhatt, "Biomaterials", 2nd edition, Narosa Publishing House, 2005.

REFERENCE BOOKS:

1. Park J.B., "Biomaterials Science and Engineering", 1st edition, Plenum Press, 1984.
2. Myer Kutz, "Standard Handbook of Biomedical Engineering and Design", Mc Graw Hill, 2003.
3. John Enderle, Joseph D. Bronzino, Susan M. Blanchard, "Introduction to Biomedical Engineering", 2nd edition, Elsevier, 2005.
4. A.C Anand, J F Kennedy, M.Miraftab, S.Rajendran, "Woodhead Medical Textiles and Biomaterials for Healthcare", 2nd edition, Publishing Limited, 2006.
5. D F Williams, "Materials Science and Technology: Vol 14, Medical and Dental Materials: A comprehensive Treatment Volume", VCH Publishers, 1992.
6. B D Ratner, AS Hoffmann, FJ Schoen and JE Lemmons, "An introduction to Materials in Medicine", Academic Press, 1996.