Subject Code : P8GT6

CORE COURSE VI - BIOMEDICAL ENGINEERING

UNIT I

Definition of biomaterials, requirements of biomaterials, classification of biomaterials, Comparison of properties of some common biomaterials. Effects of physiological fluid on the properties of biomaterials. Toxicity tests: acute and chronic toxicity studies (in situ implantation, tissue culture, haemolysis, thrombogenic potential test, systemic toxicity, intracutaneous irritation test). viscosity and capillary viscometer, Rheological properties of blood, laminar flow, Couette flow and Hagen-poiseuille equation, turbulent flow, Biotransport process, Fluid flow, Heat transfer, Mass transfer. Unified approach of momentum, flow behavior of Newtonian and Non – Newtonian Fluids, Application of momentum Heat transfer and Mass transfer principles of Biological system with particular emphasis on Human being.

UNIT II

Stainless steel, Co-based alloys, Ti and Ti-based alloys. Importance of stress-corrosion cracking. Orthopedic implants, Dental implants. Artificial implantation - Soft tissue replacement implants: Percutaneous and skin implants, Vascular implants, Heart valve implants-Tailor made composite in medium. Polyolefins, polyamides, acrylic polymers, fluorocarbon polymers, silicon rubbers, acetals. (Classification according to thermosets, thermoplastics and elastomers. Biodegradable polymers for medical purposes, Biopolymers in controlled release systems. Synthetic polymeric membranes and their biological applications.

UNIT III

Definition of bioceramics. Common types of bioceramics: Aluminium oxides, Glass ceramics, Carbons. Bioresorbable and bioactive ceramics. Mechanics of improvement of properties by incorporating different elements. Composite theory of fiber reinforcement (short and long fibers, fibers pull out). Polymers filled with osteogenic fillers (e.g. hydroxyapatite). Host tissue reactions.

UNIT IV

Review of the principles of mechanics, Vector mechanics- Resultant forces of Coplaner & Non-coplaner and Concurrent & non-concurrent forces, parallel force in space, Equilibrium of coplanar forces, Newton's laws of motion, Work and energy, Moment of inertia. Skeletal joints, skeletal muscles, basic considerations, basic assumption and limitations, forces and stresses in human joints, mechanics of the elbow, mechanics of shoulder, mechanics of spinal column, mechanics of hip, mechanics of knee, mechanics of ankle

UNIT V

Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Tissue engineering techniques and application, Application of computer in medicine, Medical imaging technique, Biochip, Biomedical instrumentation, electrodes, transducer, Biosensor, and their characteristics. Biopotential amplifiers. Biotelemetry. Recording of ECG, EEG, EMG, ERG, evoked potential etc. Cardiovascular measurement. Measurement of the respiratory system. Analytical instruments in Biomedical engineering, Oximeter, Spectrophotometer, Colorimeter, Blood gas analyzer, Blood cell counter.

Text book

Introduction to biomedical engineering by J. Ederle, S. Blancand & Bronzino, 2nd edition, Academic press (2003)

Reference Books:

1. W.R.Hendee & E.R.Ritenour, Medical Imaging Physics (3rd eds), Mosbey Year-Book, Inc., 1992.
2. W.R.Hendee & E.R.Ritenour, Medical Physics.
3. Massey and Meredeth, Medical Physics.
4. Plummer, Bio Chemistry - The chemistry of Life, Mc Graw Hill.
5. Kuchel, Bio Chemistry, Schaum Series Mc Graw Hill.
6. Patrick Rcully, Electrical Simulation & Electropathology, Cambridge University press 7. Joseph Bronzino, Biomedical Instrumentation.
8. Khandpur R S, Handbook of Analytical Instrumentation, Tata Mc Graw Hill