

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI
Hyderabad Campus
FIRST SEMESTER
2022-2023

Course Handout (Part II)

29/08/2022

In addition to part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course

Course No. : BITS F418
Course Title : Introduction to Biomedical Engineering
Instructor-in-Charge: Kumar Pranav Narayan, Pragya Komal

1. Course Description:

Introduction; Engineering principles applied for physiological phenomena; Bio-implant materials: Metallics, Ceramics; Polymeric materials for Bio-applications; Protein-biomaterials, Surface Interactions and modification of surface of the biomaterials; Tissue engineering; Drug delivery systems: principles, and applications; Biomedical sensors; Modeling and simulation.

2. Scope and Objective of the course: Biomedical Engineering is a relatively new branch of engineering that involves the use of cutting-edge technologies to help improve human healthcare. Biomedical engineers are involved in the design and creation of medical devices, implants such as stents, instruments and materials for clinical use.

3. Text Book (T):

T1: Introduction to Biomedical Engineering, Third Edition, JD. Enderle, JD Bronzino, Academic Press Series Editor, Trinity College—Hartford, Connecticut: Put as Text book. Year 2011.

T2: Principles of Biomedical Engineering Second Edition Sundararajan V. Madihall, © 2020 Artech House 685 Canton Street Norwood, MA 02062

T3: Biomedical Instrumentation and Measurements; 2nd Ed., 2007, Cromwell.L, Weibell, F.J, Pfeiffer, E.A: Pearson Education.

4. Reference Books (R):.

R1: Bronzino Biomedical Engineering Handbook, CRC and IEEE Press, Boca Raton, FL, 2000

R2: Moore J.E. and Zouridakis G. Editors-in-Chief Biomedical Technology and Devices Handbook CRC Press, 2003. 2. J. D

R3: Drug Delivery Systems Edited by Kewal K. Jain, MD Jain PharmaBiotech, Basel, Switzerland, Humana Press

R4: Encyclopedia of Biomedical Engineering (vol. 1-3): Min Wang, Xiaojun Yu, Cato Laurencin, Roger Narayan; 2018; Elsevier

R5. John G. Webster, Medical Instrumentation: Application and Design, John Wiley & Sons, 3rd Edition, 2004.

5. Course Plan:

Lecture No.	Learning Objectives	Topics to be covered	Chapter in the TextBook
1-3	Introduction	Overview, role, history of biomedical engineering, moral and ethical issue	T2 Ch 1, T1 Ch 1
4-8	Tissue Engineering and cellular engineering	Material Used in Tissue Regeneration, Scaffold Formation Techniques, Cell Culture Microenvironment, Characterization and Utilization of Products, Cellular Processes, storage of Cells and Tissues	T1 Ch 6, T2 Ch 6.5 & Ch 7
9-11	Biomaterial	Bio-implant materials: Metallics, Ceramics; Polymeric materials for Bio-application, Surface Interactions and modification of surface of the biomaterials	T1 Ch
12-14	Protein-biomaterials	Recent trends in protein and peptide-based biomaterials for advanced drug delivery, Protein based biomaterials for therapeutic and diagnostic applications	Research reviews and class notes
15-16	Biomechanics	Introduction, Basic Mechanics, Mechanics of Materials, Viscoelastic Properties, Cartilage, Ligament, Tendon, and Muscle	T1 Ch 4
17-20	Drug delivery systems: principles, and applications	Overview of various drug delivery system	R3 Ch 1
21-22	Physiological Modeling	Introduction, An Overview of the Fast Eye Movement System, The Westheimer Saccadic Eye, Movement Model, The Saccade Controller, Development of an Oculomotor Muscle Model, Saccadic Eye Movement Model, Saccade Neural Pathways	T1 Ch 13
23-26	Biosensors	Optical Sensors, Chemical Biosensors Transducers, Sensors and Electrodes in Medical Instrumentation, Biosensors Design and application	Ch6 (R2) Lecture Notes
27-30	Neuroengineering/ Introduction to Bioelectricity	Bioelectric potentials, Biopotential Electrodes, Different potentials and their propagation, Electrodes, signals and artifacts, Electrical Stimulation of CNS, Comparing electrodes, Epileptic seizures and Neuromodulation	T2 Ch 3 Lecture Notes
31-33	Biomedical Signal Processing	Introduction to biomechanics, neuroimaging tools, EEG and its application.	T1 Ch 11

34-38	Design of Medical Devices and diagnostic Instrumentation	Medical Product Design, Cardiovascular Devices, Design and product Development, Six Sigma and its Applications	T1 Ch 5
39-40	Rehabilitation Engineering	Technology and Disability, Applied universal Design, Home Modification Design and automation	Class notes

6. Evaluation Scheme:

Component	Duration	Weightage (%)	Date	Remarks
Mid-Sem Exam	90 min	30	04/11/2022, 3.30 - 5.00PM	C B
Project/ Assignments	-	30		OB
Comprehensive Exam	180 min	40	28/12/2022 AN	20CB + 20OB

7. Chamber Consultation Hour: Tentatively every Thursday, 5 PM (On call at 9505504948)

8. Notices: Notices concerning the course will be communicated through email or CMS.

9. Make-up policy: As per the clause 4.07 in the Academic regulations booklet. Only hospitalized cases will be considered for makeup.

10. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-Charge
BITS F418