

BML 300: INTRODUCTION TO HEALTHCARE ENGINEERING

L-T-P structure: 3 Credits (2-0-2)

Prerequisite(s): APL100, ELL101, MCP100

Course Status: For UG students

Class Day and Time: Lectures Mon Thu (10-11 AM) Labs (TBD)

Semester I, 2024-25 (Slot B)

Future Courses: BML401 Healthcare Entrepreneurship with BML 300 as Pre-requisite

Course Coordinator: Prof. Arnab Chanda, Centre for Biomedical Engineering (CBME), IIT Delhi

Mode of Teaching (Venue): Offline (TBD)

TOPICS AND HOURS

Sr. no.	Topics	No. of hours
1	Introduction to healthcare challenges in India, which can be met with products for diagnosis, prevention, and treatment	3
2	What is Biomechanics, Different types of biomechanics, Gait Analysis, Tissue Mechanics, Computational and Experimental Modelling, Biomechanics of Device-Tissue Interactions.	4
3	PRACTICAL Gait Analysis: Biomechanical Measurements using In-shoe Pressure Insole	4
4	What are Biomaterials? Categories, and their use across implants, tissue replacements, medical devices, and other biomedical applications. Fabrication and Applications in Medical Device Development, Wound Healing, Tissue Engineering (Bioprinting).	4
5	PRACTICAL Soft Tissue Characterization: Uniaxial, Biaxial Testing, Digital Image Correlation (DIC), Fabrication of Biomaterials: Tissue Mimicking Polymers	8
	Mid Sem Exam (12/9-18/9)	
6	Introduction to Robotics, Wearable devices, Bionic Prosthetics and Orthotics. Biosensors for Disease Diagnosis and Monitoring. Role of Artificial Intelligence (AI) and Machine Learning (ML).	4
7	PRACTICAL Biorobots and Hands-on applications	4
8	Introduction to Biomedical Imaging Techniques. Multiscale Imaging Modalities: From Cells to Organs (Microscopy). Overview of MRI, CT, and Ultrasound. Diagnosis of Key Diseases and Injuries. Latest Innovations in Medical Imaging.	4

9	Demonstration of Ultrasound Imaging, and Applications (BM)	4
10	Medical Devices and Implants. Different device Classes, their Fabrication, Testing, and Regulatory requirements. Mechanical Stability, Biocompatibility, Corrosion, Fatigue and Failure.	4
11	Additive Manufacturing and 3D Printing Lab	8
12	Recent Innovations in Healthcare Products, Clinical Testing and Role of Collaboration between Engineers and Doctors in Implementation of Valuable Biomedical Products (Case Studies).	4
15	Careers in Biomedical Engineering, Advanced Academic and Industry Research, Start-up, and Giving back to the Society.	1
	End Sem Exam (16/11-23/11)	
Total hours		28+28 (56)

COURSE EVALUATION CRITERIA:

50% Assignments, 20% Minor Exam, 20% Major Exam, 10% Attendance

GRADES:

As per department/institute rules, and to be curved as required

ATTENDANCE ISSUES AND LEAVES (IF ANY):

75% minimum as per institute norms. In case of health issues or emergencies, the course coordinator to be informed (flexible).

Reference Books:

1. Paul, Sudip, ed. Biomedical engineering and its applications in healthcare. Berlin, Germany:: Springer, 2019.
2. Ratner, Buddy D., Allan S. Hoffman, Frederick J. Schoen, and Jack E. Lemons. "Biomaterials science: an introduction to materials in medicine." MRS Bull 31 (2006): 59.
3. Eggins, Brian R. Biosensors: an introduction. Springer-Verlag, 2013.
4. Chanda, Arnab, and Gurpreet Singh. Mechanical Properties of Human Tissues. Springer, 2023.
5. Ueno, Shoogo, ed. Bioimaging: Imaging by Light and Electromagnetics in Medicine and Biology. CRC Press, 2020.
6. Singh, Mandeep. Introduction to biomedical instrumentation. PHI Learning Pvt. Ltd., 2014.