



# Biofluid Dynamics

[VIII<sup>th</sup> Semester, 4<sup>th</sup> Year]

## Course Description

**Offered by Department:**  
Biomedical Engineering

**Credits**  
3-0-0, (3)

**Status**  
Open Elective

**Code**  
BM108301BM

[Prerequisite -Nil]

## Course Objectives

1. To Make Students Understand The Basic Concepts Of Biofluid Dynamics.
2. To Create Problem Solving Ability Among Students For Biofluidic Problems.
3. To Encourage Students For Designing Computational Solution For Biofluid Domains In Physiological Events.
4. To Prepare Students For Advanced Biofluid Mechanics .

## Course Content

### Unit 1 Concepts of Biofluid Dynamics

Transport Phenomena: Biofluid Compartment Models, Tissue Heat And Mass Transfer, Joint Lubrication, Cell Transport And Microvascular Beds Cardiovascular System : Cardiovascular Transport Dynamics, Heart, Blood Vessels.

### Unit-2 Analyses of Arterial Diseases

Vessel Occlusion: Artherosclerotic Plaque Formation, Intimal Hyperplasia Development, Thrombogenesis, Particle Hemodynamics; Aneurysm: Aortic Aneurysm, Stent Graft Implant, Stented AAA Model Analysis.

### Unit-3 Biofluid Mechanics of Organ Systems

Lung : Respiratory Tract Geometry, Pulmonary Disorder And Treatment Options; Kidney: Structure And Function, Fluid Flow And Mass Transfer In Artificial Kidney Model; Liver: Structure And Function, Fluid Flow And Mass Transfer In Liver Model.

### Unit-4 Case Studies In Biofluid Dynamics

Nano Drug Delivery In Microchannels: Flow In Microchannels, Controlled Nanodrug Delivery In Microchannels; Particle Deposition And Targeting In Human Lung Airways: Nanoparticles And Microparticle Depositions In Human Upper Airway Model, Modeling Approach, Micro-Drug Aerosol Targeting In Lung Airways; Fluid Structure Interactions In Stented Aneurysms: Aneurysms And Their Possible Repairs, Stented Abdominal Aortic Aneurysm Model.

## Course Materials

### Text Books:

1. Kleinstreuer, C. (2006). Biofluid dynamics: Principles and selected applications. CRC Press

### Reference Books:

- 1 Arindam Bit; (2020) Flow dynamics and tissue engineering of blood vessels; IOP Publisher

# Drug Delivery System

[VIII<sup>th</sup> Semester, 4<sup>th</sup> Year]



## Course Description

**Offered by Department:**  
Biomedical Engineering

**Credits**  
3-0-0, (3)

**Status**  
Open Elective

**Code**  
BM108302BM

[Prerequisite -Nil]

## Course Objectives

- 1 To understand the basics about Drug Delivery system.
2. To understand the various ways of drug delivery
3. To know about pharmacokinetics and pharmacodynamics.
4. To understand the various aspects of Matrix based drug delivery system

## Course Content

### Unit 1 Drug Delivery System

Overview, dosage form-tablet, capsule, parenteral etc. classification of drug delivery system, chemically controlled system, diffusion-controlled system, controlled release mechanism-Membrane reservoir system, Matrix system, swelling controlled release system, biodegradable controlled release system.

### Unit-2 Fundamental Aspects of Drug Delivery

Introduction of pharmacokinetics and pharmacodynamics, diffusive transport, diffusion in heterogeneous system, passage of drug through membrane drug release kinetics from different biopolymer matrices.

### Unit-3 Pharmacokinetics

Common routes of systemic drug administration, drug absorption, bioavailability, determinants of bioavailability disintegration, dissolution, drug distribution, drug elimination.

### Unit-4 Matrix Based Drug Delivery System

Delivery materials, polymer-based matrices; hydrogels- drug carriers, transdermal and trans-mucosal drug delivery system, measuring in vitro diffusions, measuring controlled release kinetics, drug targeting approaches, biocompatibility aspects of matrices Immunity and immunological preparations: immunity, types, immunological preparations; bacterial vaccines, vaccines containing living viruses, vaccines containing toxoids Fundamentals of vaccine delivery.

## Course Materials

### Text Books:

1. Drug Delivery: Fundamentals and Applications, Second Edition. (2016). United States: CRC Press.
2. Drug Delivery: Principles and Applications. (2016). Germany: Wiley.

### Reference Books:

- 1 Shargel, L., Yu, A. B. (2016). Applied Biopharmaceutics & Pharmacokinetics, Seventh Edition. Singapore: McGraw-Hill Education.
2. Basic Pharmacokinetics and Pharmacodynamics: An Integrated Textbook and Computer Simulations. (2016). United Kingdom: Wiley.

# 3D Printing Technology

[VIII<sup>th</sup> Semester, 4<sup>th</sup> Year]



## Course Description

**Offered by Department:**  
Biomedical Engineering

**Credits**  
3-0-0, (3)

**Status**  
Open Elective

**Code**  
BM108303BM

[Prerequisite -Nil]

## Course Objectives

1. To Make Students Understand The Basic Concepts Of 3D Printing Technology .
2. To Create Problem Solving Ability Among Students For Making Their Own 3D Printing Solutions.
3. To Encourage Students For Designing Novel 3D Printing Approaches For Different CAD Models.
4. To Prepare Students For Entrepreneurship In The Field Of 3D Printing Technology

## Course Content

### Unit 1 Design Process Overview

Loading Fusion 360, The CAD Environment, Best Practices For Running CAD, Common CAD Files Types, CAD Libraries; A Short History Of Digital Manufacturing: Design For 3D Print, Fusion 360 Modeling, Sketching, Extruding, Collaborating On Files; Process Flow: Fusion 360 Sculpting, Moving Between Environments, Matching Imported Geometry.

### Unit-2 3DP In Public Media 3

The 3DP Business Case: Working With Meshes, Scanning Tools, Editing Scanned Files, Fixing Scan Bugs; Printing In Plastic: Optimizing For Print, Printing @ Stanford Print, De-Bugging; Printing In Metal: Making Assemblies, Moving And Aligning, Parts Joints.

### Unit-3 Bioprinting Approaches

Printing In Glass, Wood, Concrete & More: Prototype II, Fasteners, Finishes, Advanced Modeling Tools; Bioprinting: Working With Service Providers, Optimizing Files For Different Methods, Debugging Prints; Politics & Ethics: CAD Rendering, Mechanical Drawings, Photographing Parts.

### Unit-4 Different 3D Printing Techniques

Stereolithography (SLA), Selective Laser Sintering (SLS), Fused Deposition Modeling (FDM), Digital Light Process (DLP), Multi Jet Fusion (MJF), Polyjet. Direct Metal Laser Sintering (DMLS), Electron Beam Melting (EBM).

## Course Materials

### Text Books:

1. Lipson, H., & Kurman, M. (2013). *Fabricated: The new world of 3D printing*. John Wiley & Sons.
2. France, A. K. (2013). *Make: 3D printing: the essential guide to 3D printers*. Maker Media, Inc..

### Reference Books:

1. Rapid Prototyping Journal (ISSN 1355-2546)
2. International Journal of Rapid Manufacturing (ISSN 1757-8817)
3. Virtual and Physical Prototyping (ISSN 1745-2759)

# Health Care Management

[VIII<sup>th</sup> Semester, 4<sup>th</sup> Year]



## Course Description

**Offered by Department:**  
Biomedical Engineering

**Credits**  
3-0-0, (3)

**Status**  
Open Elective      **Code**  
BM108304BM

[Prerequisite -Nil]

## Course Objectives

1. Learn concepts and theories in Health Care Management
2. Learn to understand perspectives and values of Health Care Management
3. Develop the basic management skills and ability to work productively with others
4. Develop skills in using materials tools and/or technology central to Health Care Management
5. Integrate health care management theory with real world situations

## Course Content

### Unit 1 An Overview of Healthcare Management, Leadership and Motivation

Introduction, Definition and Dimensions of health, Philosophy of Healthcare Management, History and Future of Healthcare Management, Management: Definition, Function, and Competencies, Role of Manager; Leadership vs Management, Leadership Styles, Ethical Responsibility, Motivation, Measuring Engagement, Organizational Behavior and Management Thinking – Four Key Features of Thinking, Socio-Emotional Intelligence, Strategic Planning – SWOT Analysis, Strategy Identification and Selection

### Unit-2 Healthcare Marketing, Quality and Information Technology

Introduction and History of Healthcare Marketing, Strategic Process, Ethics and Social Responsibility; Quality in Healthcare, Patient-Centered Care, Common Elements of Quality and Improvement, Approaches and Tools for Quality Improvement, Health Information System, Healthcare Information Technology, Financial Management in Healthcare, Controlling Costs, Managing Budget.

### Unit-3 Strategic Management of Resources, Teamwork, Law and Ethics

Environmental Forces Affecting Human Resources Management, Workforce Planning/ Recruitment, Challenges of Teamwork in Healthcare Organization, Emotions and Teamwork, Organizational Learning, Role of Individuals and Communities in Addressing Health Disparities, Healthcare Law, Malpractices, Ethical Concepts, Rights and Responsibilities of Patient and Provider

### Unit-4 Regulation, Compliance and Special Topics

Frauds and Abuse, Antitrust Issues, Emergency and Disaster Management, Innovations in Healthcare Management – Global Trends in Health System Innovation, Public Health Innovations, Leapfrog through mHealth, Initiatives by Indian Government, Bioterrorism and Violence in Health Care Settings, Medical Tourism, Consumer-Directed Health Care, Opportunities for Research on Emerging Issues, Case studies.

## Course Materials

### Text Books:

1. Kite, B. J., Shanks, N. H., Buchbinder, S. B. (2019). Introduction to Health Care Management. United States: Jones & Bartlett Learning, LLC.
2. Singh, V.K., Lillrank, P, Innovations in Healthcare Management: Cost-Effective and Sustainable Solutions. (2015). United States: Taylor & Francis.

### Reference Books:

1. Amelung, V. E. (2020). Healthcare Management: Managed Care Organisations and Instruments. Germany: Springer Berlin Heidelberg.
2. Dracopoulou, S. (2006). Ethics and Values in Healthcare Management. United Kingdom: Taylor & Francis.