COURSE CODE	COURSE TITLE	L	T	P	C
1152BM109	BIO FLUID DYNAMICS	2	2	0	3

PREAMBLE

To develop competencies in fluid mechanics principles using practicalexamples of how fluid mechanics knowledge is applied to biomedical applications

PREREQUISITE

Anatomy and Physiology & Engineering Mechanics.

LINKS TO OTHER COURSES
Biomechanics

COURSE OUTCOMES

Upon successful completion of the course the students will be able to

S.No	Course outcome	Skill Level
1	Solve problems on different types of fluid flow	K2
2	Solve problems on fluid kinematics	K3
3	Appreciate the transport dynamics of cardiovascular system	K3
4	Solve problems on vessel occlusion	K3
5	Appreciate the significance of fluid mechanics in physiology	K3

Correlation of COs with POs :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	L	H									
CO2	M											
CO3	M		H									
CO4	M											
CO5	L		M									

H- High; M-Medium; L-Low

COURSE CONTENT

UNIT I CHARACTERISTICS AND FUNDAMENTALS OF FLOW. 12

Introduction to fluid: Units and dimensions- Density, Specific gravity and specific volume, Viscosity, Surface tension, Compressibility, Characteristics of a perfect gas, Problems.

Streamline and Stream tube, Steady and Unsteady flow, Laminar flow and turbulent flow, Reynolds number.

UNIT II FLOW OF VISCOUS FLUID 12

Continuity equation, Navier- Stokes equation, Velocity distribution of laminar flow, Velocity distribution of turbulent flow, Boundary layer, Theory of lubrication.

UNIT III BIOFLUID DYNAMICS CONCEPTS 12

Biofluid- compartment Models, Tissue Heat and Mass Transfer, Joint lubrication, Cell Transport and Microvascular Beds, Cardiovascular System: Cardiovascular Transport Dynamics- The Heart- The Blood Vessels.

UNIT IV VESSEL OCCLUSIONS 12

Artherosclerotic plaque Formation- A particle Hemodynamics Model- A Pathway model for artherogenesis. Intimal Hyperplasia Development- Particle Hemodynamics- Equations of Particle Motion- Near wall Forces- Hemodynamic wall parameters.

UNIT V FLUID MECHANICS OF ORGAN SYSTEMS. 12

LUNGS: Respiratory Tract Geometry- Pulmonary Disorders and Treatment Options. KIDNEYS: Kidney Structure and Functions- Fluid flow and Mass Transfer in an Artificial Kidney Model. LIVER: Liver Structure and Functions- Fluid flow and Mass Transfer in a Liver Model. Problems.

TOTAL : 60 periods

TEXT BOOKS

1. Yasuki. Nakayama & Robert Boucher "Introduction to Fluid Mechanics" Arnold; J. Wiley & Sons- 1999 ISBN: 0-340-67649-3
2. Clement Kleinstreuer "BIOFLUID DYNAMICS Principles and Selected Applications" Taylor and Francis Group CRC Press. ISBN: 978-1-4200-0397-0

REFERENCE BOOKS

1. An Introduction to Biomechanics: Solid and Fluids, Analysis and Design, J.D. Humphrey, S.L. Delange, 2004, Springer-Verlag, New York
2. Transport Phenomena in Biological Systems, 2nd edition, G.A. Truskey, F. Yuan, D.F. Katz, 2009, Pearson Prentice Hall.
3. McDonald's Blood Flow in Arteries, 6th edition, W.W. Nichols, M.F. O'Rourke, C. Vlachopoulos, 2011, CRC Press.