Minor in Medical Diagnostics and Therapeutic Technology Curriculum

Sl. No	Course Name	Semester	Credit
1	Basics of Human Anatomy & Physiology		3
2	Biomedical Instrumentation		3
3	Bio-MeMs & Nanotechnology		3
4	Medical Imaging		3
		Total	**12**

Basics of Human Anatomy & Physiology

Course Outcomes

Given the introductory nature of the course, the students will be able to:

1) Learn the concepts of the different levels of structural organization that make up the human body.
2) Understand the organ level organization within the human body. .
3) Understand the functioning and functional importance of the various organs.

Course Content

- Bones of an appendicular skeleton – Scapula, humerus, radius, ulna, Joint - Hip, Femur, ankle, and foot
- Principal Muscles – Deltoid, Biceps, triceps, respiratory, abdominal and gluteal
- Systemic physiology: Nervous System, Neuromuscular System, Circulatory system; Respiratory and Cardiovascular system.

Text Books/Reference Books

1) Arthur C. Guyton: Textbook of Medical Physiology, 8th ed, Prism Books (Pvt) Ltd & W.B. Saunders Company, 1991.
2) W. F. Ganong, Review of Medical Physiology, 13th ed., Prentice-Hall, 17th edition, 1995.

Biomedical Circuits and Instrumentation

Course Outcomes

The students will be introduced to:

1) Basic Medical Devices such as ECG, EEG, Thermometer
2) Understand the key physiological processes such as cardiac activity, respiration, etc.
3) Become aware of practical considerations during physiological measurements.

Course Contents

- Origins of the ECG, multi-lead ECG system, ECG analysis, heart Rate & HRV.
- Brain Function: EEG, EEG Waves, and their significance, EEG electrode placement schema, origin and mitigation of noise in EEG.
- Cardiac Action Potential and EEG measurement: Precautions, basic signal Analysis.

Text Books/Reference Books

1) Handbook of Biomedical Instrumentation (Third edition): R S. Khandpur. (PH Pub)
2) Introduction to Biomedical Equipment Technology: Carr Brown. (PH Pub)
3) Encyclopedia of Medical Devices and Instrumentation: J G. Webster. Vol I- IV (PH Pub)

Bio-MeMs & Nanotechnology

Course Outcomes

This introductory course aims to provide students with:

1) Overview of the operation of micro- and nano-scale devices.
2) Insights into design of such devices using relevant mechanical/electrical engineering principles.
3) Knowledge of use-case and application areas for such devices.

Course Content

- Introduction: micro- and nano-scale size domains; scaling of physical laws; MEMS materials and processes; MEMS devices and applications
- Micro total analysis system (μTAS): Fluid control components, μ-TAS: sample handling, μ-TAS: separation components, μ-TAS: detection, cell handling, and characterization systems, systems for biotechnology and PCR
- Implantable devices, neural interfaces, microsurgical tools, micro needles, drug delivery, MEMS metrology, MEMS packaging.

Text Book

1) Foundations of MEMS, Chang Liu, Prentice Hall (2006)
2) Fundamentals of Micro fabrication, Marc Madou, CRC (2002)

3) Introduction to BioMEMS – Albert Folch, CRC (2012)

Medical Imaging

Course Outcomes

This introductory course:

1) Familiarizes the students with the physics of medical imaging.
2) Highlights the various sources of signals & their relation to tissue features.
3) Introduces the building blocks of medical imaging instruments.

Course Content

- US imaging- Ultrasound wave propagation in homogenous medium, scattering, absorption and attenuation of ultrasound waves in tissue, pulse-echo imaging,
- Optical coherence tomography-Michelson Morley experiment, X-ray imaging-Instrumentation, mechanism of attenuation of X-ray in tissue
- MRI imaging-angular momentum, nuclear magnetic moment, Zeeman effect, Larmour precision, T 1, T 2, T 2 * relaxations, chemical shift, free induction decay

Text Books/Reference Books

1) The Essential Physics of Medical Imaging, Bushberg, Lippincott, Williams and Wilkins, Third Edition.
2) The Physics of Medical Imaging, Webb, CRC Press, 1988.

Tissue Engineering & Gene Therapy

Course Outcomes

This introductory course aims to give students basic idea about:

1) Various types of materials used for development tissues and organs
2) Provide idea of translating material properties from test data to material performance.
3) Provide knowledge of interaction of materials with the human body

Course Content

- Classification of Materials. Fundamentals of biomaterials science. Evolution of biomaterials. Physic-chemical properties of biomaterials: mechanical (elasticity, yield stress, ductility, toughness, strength, fatigue, hardness, wear resistance).
- Natural polymers in the synthesis of biomaterials, Degradable polymers, Surface treatments, and analysis. Case study of a few advanced biomaterials.
- Cell-Biomaterial Interactions and Host Integration. Concept of biocompatibility. Cells, Tissue organization, Structure, morphology and Properties, Cell-matrix interactions. Stem cell Engineering.

Text Books/Reference Books

1) Lanza RP, Langer R, Vacanti JP, Principles of Tissue Engineering, Academic Press, 3rd Edition (2007).
2) Palsson B and Bhatia SN, Tissue Engineering, Pearson Prentice Hall (2003).
3) Biomaterials Science: An Introduction to Materials in Medicine - Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, second sedition.