SEMESTER-V
DEPARTMENT OF INSTRUMENTATION
Category I

(B.Sc. Honours in Instrumentation)

DISCIPLINE SPECIFIC CORE COURSE – 13: Advance Biomedical Instrumentation (INDSC5A)

CREDIT DISTRIBUTION, ELIGIBILITY, AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Advance Biomedical Instrumentation (INDSC5A)	04	02	-	02	Class XII passed with Physics + Mathematics/Applied Mathematics + Chemistry/ Computer Science/Informatics Practices	Biomedical & Electronic Instrumentation

Learning Objectives

The Learning Objectives of this course are as follows:

- To realize the importance of the instruments used in critical care units of the hospital.
- To understand the principle behind the measurement of biochemical signals.
- To understand the concept of instruments used in medical imaging diagnostics and therapeutics.
- To appreciate the efficiency of the surgical and diathermy apparatus in the medical incision.

Learning outcomes

The Learning Outcomes of this course are as follows:

- Understand instruments used in critical care and operating units of hospitals
- Gain knowledge of the instruments used for biochemical analysis in healthcare
- Understand the concepts of various medical imaging techniques and their applications

- Understand instruments used for medical assistance and therapy

SYLLABUS OF DSC-13

Unit-1 **(8 Hours)**

Ventilators: Basic principles and types of ventilators.

Anaesthesia Machine: Need of anaesthesia, anaesthesia delivery system, breathing circuits. **Clinical Laboratory Instruments**: General principle and working of Blood Gases Analyzer, Auto-analyser, Blood Cell Counters, ELISA reader.

Unit-2 **(8 Hours)**

Medical Imaging System: Ultrasound, properties, its generation & detection, types of transducers, real-time ultrasonic imaging, linear array scanners, X-ray computed tomography (CT Scanner) principle, contrast scale, scanning system, processing Unit, viewing, storage. Magnetic Resonance Imaging: Basic principle, working and construction.

Unit-3 **(6 Hours)**

Nuclear Medicine System: radioactive emissions, gamma camera, imaging system, ECT (emission coupled tomography) and its different approaches: positron emission tomography (PET), Single-photon emission computed tomography (SPECT).

Unit-4 **(8 Hours)**

Surgical Scopy and Diathermy Equipments: Fibre Optics- Endoscopes -light sources, video processors, camera, and fibre optic cable, Principles and applications. Diathermy: Working Principle, Construction, and different types (Infrared radiation (IR), ultraviolet (UV), short wave, microwave, ultrasonic, and Surgical Diathermy).

Practical component: **(60 Hours)**

1. Study of ultrasound transducers based on the medical system.
2. Study of vital organs (such as Heart, Kidney, liver, etc) using Ultrasonography.
3. Demonstration of X-ray/Computed Tomography/nuclear imaging.
4. Experiment based on clinical instruments such as Blood cell counter/ ELISA reader.
5. Estimation of serum total protein using a spectrometer.
6. Estimation of sodium and potassium in blood serum or urine sample.
7. Project based on designing and applications of Biomedical Instrumentation.

Essential/recommended readings

1. Carr J. J, Brown J. M. Introduction to Biomedical Equipment Technology, Fourth edition, Pearson Education Inc (2010), 2nd edition
2. Khandpur R.S., Handbook of Biomedical Instrumentation, Second edition, Tata McGraw- Hill Publishing (2009), 2nd edition

3. Joseph D. Bronzino, The Biomedical Engineering Handbook, IEEE Press (2015), 4th edition, Volume 1.
4. Richard Aston, Principles of Biomedical Instrumentation & Measurement, Merrill Publishing Company, (1990), 1st edition
5. Mandeep Singh, Introduction to Biomedical Instrumentation, PHI learning private limited (2014), 2nd Edition.
6. Cromwell L., Wiebell F. J., Pfeiffer EA, Biomedical Instrumentation and Measurements, Second edition, Prentice Hall (2010), 2nd Edition.

Suggestive readings

1. John G Webster, Medical Instrumentation Applications and Design, John Willey, 5th Edition, 2020.
2. L A Geddes, L E Baker, Principles of Applied Medical Instrumentation, John Wiley, Edition 3, 1989.

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.