

<b>Semester:</b>	7				
<b>Course Code:</b>	ME5140				
<b>Course Name:</b>	Biomedical Instrumentation I				
<b>Credits Value:</b>	3 (Notional hours: 150)				
<b>Pre-requisites:</b>	None				
<b>Core/ Optional:</b>	Optional				
<b>Hourly Breakdown</b>	Lectures (hours)	Tutorials (hours)	Practical classes (hours)	Assignments (hours)	Independent Learning & Assessment (hours)
	38	04	01	05	102

**Course Aim:** This course is aimed at providing an in-depth understanding of working principles, main and functional components of commonly used biomedical instruments, and general design steps for the development of typical biomedical instruments.

**Intended Learning Outcomes:**

At the end of this course, students should be able to;

- **define** basic medical terms & physical parameters that are associated with medical instrumentation,
- **describe** sensors and their principles in relation to medical parameters for diagnostics,
- **demonstrate** measuring of blood pressure and sound,
- **calculate** and analyze flow and volume of blood.

**Course Content:**

- **Introduction:** Introduction to biomedical engineering, introduction to the course
- **Basic Concepts of Medical Instrumentation:** Classification of biomedical instruments and devices, a generalized medical instrumentation system, system-transfer function, outline of the design process: from concept to clinical device, engineering design, regulation of biomedical instrumentation and devices, safety of biomedical instrumentation and devices, ISO and IEC (International Electrotechnical Commission) standards, procedures adapted for testing and evaluation of a new device
- **Basic Sensors and Principles:** Displacement Measurements, resistive sensors, bridge circuits, inductive sensors, phase-sensitive demodulators, capacitive sensors, piezoelectric sensors, accelerometer, temperature measurements, thermocouples, thermistors, radiation thermometry, fiber-optic temperature sensors, optical measurements (micro-PIV)
- **Blood Pressure and Sound:** Direct measurements, harmonic analysis of blood-pressure waveforms, dynamic properties of pressure measurements, systems for measuring venous pressure, heart sounds, phonocardiography, effects of potential and kinetic energy on pressure

measurements, indirect measurements of blood pressure

- **Measurement of Flow and Volume of Blood:** Indicator-dilution methods (continuous and rapid infusion), electromagnetic flow meters, ultrasonic flow meters, thermal-convection velocity sensors, plethysmography

**Teaching/ Learning Methods:**

Classroom lectures, tutorials, in-class exercises and assignments

**Assessment Strategy:**

<b>Continuous Assessment</b> 50%		<b>Final Assessment</b> 50%		
Details:		Theory (%)	Practical (%)	Other (%) (Project)
Labs	10%	50%		
Tutorials/Assignments/Quizzes	20%			
Mini project	20%			

**Recommended Reading:**

- Webster, J. G. (Ed.). (2009). *Medical instrumentation: application and design*. John Wiley & Sons.
- Webb, A. G. (2018). *Principles of biomedical instrumentation*. Cambridge University Press.
- Tagawa, T., Tamura, T., & Oberg, P. A. (2019). *Biomedical sensors and instruments*. CRC press.