Subject Description Form

Subject Code	BME31121
Subject Title	**Fundamentals of Biomedical Instrumentation II**
Credit Value	3
Level	3
Prerequisite	BME21120 Fundamentals of Biomedical Instrumentation I
Objectives	To allow students to gain fundamental knowledge on analog and digital electronics, and let students have solid experience on electronic components and circuits.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Demonstrate understanding of semiconductor materials, analog and digital components, and their evolution and inter-relationship; b. Analyze basic transistor amplification circuit, logic circuits, and circuits for registers and counters; c. Apply Boolean algebra in the logic circuit analysis and design; d. Explain analog-to-digital and digital-to-analog conversion and their important applications in bioinstrumentation; e. Demonstrate understanding of fundamental principles of microprocessors; f. Design simple circuits and systems using analog and digital electronic components.
Contribution to Programme Outcomes (Refer to Part I Section 10)	▪ Programme Outcome 1: Demonstrate an ability to apply knowledge of mathematics, science, and engineering appropriate to the Biomedical Engineering (BME) discipline. (Teach and Practice) ▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Teach and Practice) ▪ Programme Outcome 3: Demonstrate an ability to design a system, component, or process relevant to BME to meet desired needs within realistic constraints, such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability. (Teach)

	■ Programme Outcome 7: Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for BME practice. (Teach and Practice) ■ Programme Outcome 8: Demonstrate an ability to use the computer/IT tools relevant to the BME discipline along with an understanding of their processes and limitations. (Practice) ■ Programme Outcome 9: Demonstrate an ability to function in multi-disciplinary teams. (Practice) ■ Programme Outcome 11: Demonstrate an ability to communicate effectively and advise clients, professional colleagues, and other members of the community. (Practice)
Subject Synopsis/ Indicative Syllabus	■ Semiconductor materials and diodes: Semiconductor materials silicon; generation of electron–pole pair; P–N junction; forward and reverse bias of P–N junction; diodes. ■ Semiconductor transistors (BJT, JFET, and MOSFET): Operation of BJT; DC load line; small signal equivalent circuit; JEFT and MOSFET transistor operational principles and characteristics. ■ Flip-flop and memories: Analysis of RS latch, D flip-flop, JK flip-flop, and T flip-flop; understand memory construction. ■ Register and counters: Asynchronous and synchronous counters: modulo-x counter; shift register; general purpose register. ■ D/A and A/D converters: Concept of analog-to-digital and digital-to-analog converter; binary weighted and R-2R network for DAC; simultaneous and counter type ADC; specifications of ADC and DAC. ■ Computer structures and microprocessor: Memory (RAM and ROM); storage; programmable logic; CPLD; FPGA; microprocessor structure; internal bus; assembly programming; serial and parallel bus.
Teaching and Learning Methodology	Students will learn in lectures the principles of analog and digital electronic components and microprocessor and their applications in biomedical instrumentation. Real circuits, components, and circuit boards are used in the laboratory sessions to enhance students' understanding of the principles. Various examples of medical devices will be introduced during the lectures of electronic devices.

Assessment Methods in Alignment with Intended Learning Outcomes	Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)							
			a	b	c	d	e	f		
	Homework assignments	15%	√	√	√	√	√			
	Lab performance and lab report	20%	√	√	√	√	√	√		
	Mid-term exam	15%	√	√	√	√	√	√		
	Final exam	50%	√	√	√	√	√	√		
	Total	100%								

Note: To pass this subject, students must obtain grade D or above in both continuous assessment and final examination.

Explanation of the appropriateness of the assessment methods in assessing the intended learning outcomes:

The assignments and exams are used to assess the degree that the students understand the knowledge and ability to apply the knowledge to solve problems.

The lab sessions are focused on testing the student on how much they gain practical experience and apply knowledge to solve real questions.

Student Study Effort Expected	Class contact:	
	▪ Lectures	27 Hrs.
	▪ Lab experiments	12 Hrs.
	Other student study effort:	
	▪ Self-study	67 Hrs.
	▪ Assignment and lab report	20 Hrs.
	Total student study effort	126 Hrs.

Reading List and References	e. Floyd TL. Electronic Devices. 9th/8th ed. Pearson/Prentice Hall, 2012/2008.
	f. Floyd TL. Digital Fundamentals. 10th/9th ed. Prentice Hall, 2009/2006.
	g. Reddy SR. Electronic Devices and Circuits. Pangbourne: Alapha Science International, 2004.
Date of Last Major Revision	14 July 2014
Date of Last Minor Revision	13 August 2017