Subject Description Form

Subject Code	BME21148
Subject Title	**Biomedical Electronics**
Credit Value	3
Level	2
Co-Requisite	AMA2511 Applied Mathematics I
Objectives	This course aims to provide the students appropriate fundamental knowledge in understanding and analyzing electronic circuits and systems.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a. Demonstrate understanding of the I–V characteristics of passive components including resistors, capacitors, and inductors and active current sources and voltage sources; b. Capable of analyzing electric circuit and system containing resistors, capacitors, and inductors for transient and steady-state response; c. Explain the input and output characteristics of operational amplifier; d. Use DC power supplier, function generator, and oscilloscope in the circuit design and analysis. e. Demonstrate understanding of semiconductor materials, analog and digital components, and their evolution and inter-relationship; f. Analyze basic transistor amplification circuit, logic circuits, and circuits for registers and counters; g. Explain analog-to-digital and digital-to-analog conversion and their important applications in bioinstrumentation; h. 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, Practice and Measure) ▪ Programme Outcome 2: Demonstrate an ability to design and conduct BME experiments, as well as to analyze and interpret data. (Teach, Practice and Measure) ▪ 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)

Subject Synopsis / Indicative Syllabus	▪ Resistive circuits analysis methods and theorems: Node voltage and mesh current methods for resistive circuit analysis; ▪ Source transformation; superposition; Thevenin's and Norton's theorems. ▪ Operational amplifier: Ideal operational amplifier conditions; resistive circuit analysis with operational amplifier; ▪ Energy storage elements: Capacitor and inductor; I–V characteristics of capacitor and inductor; energy storage incapacitor and inductor; Complete response of RL and RC circuits: ▪ Circuit analysis with energy storage elements; first order circuit; transient response analysis; initial condition and steady-state conditions. ▪ Sinusoidal steady-state analysis and filters: Sinusoidal source; steady-state response of RL and RC circuit; complex exponential forcing function; phasor; impedance. ▪ 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): Operation of BJT; DC load line; small signal equivalent circuit. ▪ 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 anddigital-to- analog converter; binary weighted and R-2Rnetwork for DAC; simultaneous and counter type ADC; specifications of ADC and DAC.
Teaching / Learning Methodology	Lectures will teach fundamentals and applications of circuits and systems illustrated with ample examples in biomedical engineering. Three hands-on laboratory sessions provide students with practical experiences in constructing circuits and systems using real components, and measuring their performance using common electronic test and measurement equipment.

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	g	h
1. Homework assignments and mid-term exam	50%	√	√	√		√	√	√	
2. Lab performance and lab report	10%	√	√	√	√	√	√	√	√
3. Final exam	40%	√	√	√		√	√	√	
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 focus on testing the student on how much practical experience they gain and apply knowledge to solve real questions.

Student Study Effort Expected

Class contact:	
▪ Lectures	30 Hrs.
▪ Lab experiments	9 Hrs.
Other student study effort:	
▪ Self-study	60 Hrs.
▪ Assignment and lab report	18 Hrs.
Total student study effort	117 Hrs.

Reading List and References

- Svoboda JA and Dorf RC. Introduction to Electric Circuits, 9th ed. Wiley & Sons, 2014.
- Floyd TL. Electronic Devices. 10th ed. PrenticeHall, 2018.
- Floyd TL. Digital Fundamentals. 11th ed. PearsonEducation, 2015.

Date of Last Major Revision

28 December 2021

Date of Last Minor Revision

28 December 2021