Academic Year	2023/2024	**Semester**	2
Course Coordinator	Dr. Pui Tze Sian		
Course Code	BG2104		
Course Title	Electronics for Biomedical Engineers		
Pre-requisites	nil		
No of AUs	3		
Contact Hours	*26 hours lecture, 12 hours tutorial*		
Proposal Date	*9 Nov 2023*		

Course Aims

The course aims to introduce you the fundamental of electronic devices and knowledge for design electronics circuits for biomedical applications. The knowledge and skills learnt will support you in preparation for future study (e.g. for course such as Bioinstrumentation and medical device design) and career in biomedical industry.

Intended Learning Outcomes (ILO)

By the end of this course, you (as a student) would be able to:

1. Explain the scientific principles that apply to basic flow of electricity and the technique in circuit analysis
2. Analyze complex electronic circuits, such as circuit with many loops and nodes
3. Comprehend multiple electronic components and their connections to design functioning electronic circuit
4. Apply appropriate techniques to diagnose faults in diode and transistor circuits

Course Content

Fundamental principles of circuit theorems and circuit elements. Circuit analysis in frequency domain. Bipolar junction transistor. Field effect transistor. Operation amplifier (Op-Amp)

Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual	Assessment rubrics
1. Final Examination [2hrs; Closed Book]	1,2,3,4	EAB SLO a, b,	60%	Individual	
2. Continuous Assessment 1 (CA1): Quiz	1,2	EAB SLO a, b	10%	Individual	Refer to Appendix 1
3. CA2: Assignment	3,4	EAB SLO a, c,	15%	Team	Refer to Appendix 2
4. CA3: Quiz 2	2,3	EAB SLO a, c,	15%	Individual	Refer to Appendix 1
Total			100%		

Formative feedback

Examination results;
Marker's report on overall examination performance will be uploaded to NTUlearn;
Quiz answers will be discussed in class

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Lecture	Demonstrate how to carry out a procedure such as working through a problem, use incomplete handouts which enabling students participating in class.
Tutorial	TBL classroom discussion sessions on tutorial questions and related topics

Reading and References

- Electronics Devices, and Circuits, conventional flow version, Hassul & Zimmerman, Pearson, ISBN 9789810676896
- Electronics Devices and Circuits, Conventional Current Version, Thomas L. Floyd, Pearson, ISBN 9781292025643

Course Policies and Student Responsibilities

General: Students are expected to complete all online activities and take all scheduled assignments and tests by due dates. Students are expected to take responsibility to follow up with course notes, assignments and course related announcements. Students are expected to participate in all tutorial discussions and activities.

Continuous assessments: Students are required to attend all continuous assessments.

Absenteeism: Continuous assessments make up a significant portion of students' course grade. Absence from continuous assessments without officially approved leave will result in no marks and affect students' overall course grade.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not

knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information.

On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning.

Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Dr. Pui Tze Sian	N1.3 B2-12	6790 4485	tspui@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Basic circuit analysis with Ohm's law	1	Face to face lecture, Pre-tutorial video
2	Complex circuit analysis with nodal voltage and mesh current method	1,2	Face to face lecture, Tutorial 1 circuit analysis
3	Characteristics of semiconductor diodes and principle operation of bipolar junction transistor	1,3,4	Face to face lecture, LAMS activity, Assignment
4	The Common emitter amplifier circuit	2,3	Face to face lecture Tutorial 2 Common emitter amplifier circuit
5	The box model and multistage amplifier	2,3	Face to face lecture, Tutorial 3 box model

6	The emitter follower circuit	2,3	Face to face lecture Quiz 1 Tutorial 4 Emitter follower circuit
7	The common base amplifier and troubleshooting BJT	3,4	Face to face lecture, Tutorial 5 Common base amplifier
Recess			
8	The DC behaviour and states of the JFET	1	Face to face lecture
9	P-Channel JFET	1,2	Face to face lecture Tutorial 6 JFET
10	Operational amplifier	2,3	Face to face lecture Tutorial 7 Operation amplifier
11	Summing amplifier	2,3	Face to face lecture Tutorial 8 Summing amplifier
12	Frequency response and the Bode gain plot	3,4	Face to face lecture Quiz 2
13	Low frequency amplifier behaviour	3,4	Face to face lecture Tutorial 9 Frequency response

Appendix 1: Assessment Criteria for Quiz 1 and Quiz 2

Criteria	Unsatisfactory: <40%	Bordeline: 40% to 49%	Satisfactory: 50% to 69%	Very good: 70% to 89%	Exemplary: >90%
Knowledge Understanding scientific principles that apply to basic flow of electricity and the techniques in circuit analysis.	• Lacks understanding of theories, laws, concepts, and terms governing the basic flow of electricity. • Unable to apply the theories and concepts to solve circuit problems.	• Partial understanding of theories, laws, concepts, and terms governing the basic flow of electricity. • Can apply the theories and concepts to solve simple circuit problems	• Good understanding of the theories, laws, concepts, and terms governing the basic flow of electricity. • Can apply the theories and concepts to solve medium level circuit problems	• Good and comprehensive understanding of the theories, laws, concepts, and terms governing the basic flow of electricity • Can apply the theories and concepts to solve complicated circuit problems	• Very good and comprehensive understanding of theories, laws, concepts, and terms governing the basic flow of electricity • Can apply the theories and concepts to solve all circuit problems
Analysis The ability to analyse complicate circuits, such as circuit with many loops and nodes.	Unable to understand possible application of electronic systems and apply the knowledge to test and modify the system.	Can read and partially understand possible application of electronics systems but unable to apply the knowledge to test and modify the system.	Can read and understand possible application of electronics systems and apply the knowledge to test the system.	Can read and understand possible application of electronics systems and apply the knowledge to test and modify the system.	Can read and understand possible application of electronics systems and apply the knowledge to test, modify and optimize the system.

Appendix 2: Assessment Criteria for assignment 1

Criteria	Unsatisfactory: <40%	Bordeline: 40% to 49%	Satisfactory: 50% to 69%	Very good: 70% to 89%	Exemplary: >90%
Comprehension The ability to comprehend multiple electronic component and their connection to design functioning electronic circuit	Unable to understand the components and recognize various type of circuit configurations	Some understanding of the components but unable to recognize the circuit configurations	Understands the components, their functions and the circuit configurations.	Understands the components and functionality in their respective configuration very well and most likely can predict the behavior.	A thorough understanding of the components and their function. Can tell the circuit configuration used to develop specific functions.
Application Applying theories and use appropriate methods to diagnose faults in diode or transistor circuit.	Unable to understand possible application of electronic systems and apply the knowledge to test and modify the system.	Can read and partially understand possible application of electronics systems but unable to apply the knowledge to test and modify the system.	Can read and understand possible application of electronics systems and apply the knowledge to test the system.	Can read and understand possible application of electronics systems and apply the knowledge to test and modify the system.	Can read and understand possible application of electronics systems and apply the knowledge to test, modify and optimize the system.