Xi'an Jiaotong-Liverpool University
西交利物浦大学

Department of Electrical and Electronic Engineering

MODULE HANDBOOK

EEE109

Electronic Circuits

Bing Han, Yuqing Chen

Semester 1

2020/2021

SECTION A: Basic Information

- **Brief Introduction to the Module**

EEE109 (Electronic Circuits) is a 5 credit module. It is one of the most fundamental modules in electronic engineering. The module introduces students to the science of the motion of changes in a semiconductor, the mechanism of different diodes and transistors, and how an amplifier is designed and analysed. As a year-2 module in semester 1, EEE109 is considered a challenging module conventionally. For most of the students who encounter the concepts of electronics for the first time, the module may be fascinating yet students may be overwhelmed by the abstruse physical mechanism and technical terms, i.e., when trying to relate the knowledge in both micro and macro electronic worlds.

To achieve the best result and most rewarding experience in EEE109, the module leaders would suggest students to be persist. Students are advised to prepare well before the lecture (read the lecture notes and related book chapters), and make good use of the supports available during the semester, e.g., tutorials/recitation sessions, TAs and teachers' office hours.

There are four assessment items in EEE109 including:

1) Final Exam (60%);
2) Midterm Exam (15%);
3) Assignments (10%);
4) Lab Reports (15%).

The modes of delivery cover lectures, tutorials, casual class assignments (no credit attached), and labs. The resit exam is arranged at the end of Semester 2. It is weighted as 100% of the final module mark. It means that other components (Midterm Exam, Assignments or Lab Reports) assessed in Semester 1, regardless of whether or not the student passed or failed, will not be included in the calculation of the final module mark after resit.

- **Key Module Information**

Module name: *Electronic Circuits*

Module code: *EEE109*

Credit value: *5*

Semester in which the module is taught: *S1*

Pre-requisites needed for the module: *None*

Programmes on which the module is shared:

BEng Computer Science and Technology
BEng Digital Media Technology
BEng Electrical Engineering
BEng Electronic Science and Technology
BEng Telecommunications Engineering
BEng Mechatronics and Robotic Systems

- **Delivery Schedule**

Lecture room:

Online

Lecture time:

Group 1: Tuesday: 09:00-11:00;
Group 2: Wednesday: 09:00-11:00;

Tutorial time:

Group 1: Friday: 11:00-12:00,
Group 2: Friday: 16:00-117:00,

Lab room:

EE205 EE211 EE213 EE215
EE305 EE309 EE311 EB369 EB447

Lab time:

Tuesday: 11:00-13:00, 14:00-18:00, Week 7, 9-13.

- **Module Leader and Contact Details**

Name: *Bing Han*

Brief Biography: *XJTLU Website*

Email address: *bing.han@xjtlu.edu.cn*

Office telephone number: *+86 (0)512 8816*

Room number and office hours: *EE220; 14:00-16:00 every Monday and Thursday*

Preferred means of contact: *bing.han@xjtlu.edu.cn*

- **Additional Teaching Staff and Contact Details**

Name: Yuqing Chen

Brief Biography:

Email address: yuqing.chen@xjtlu.edu.cn

Office telephone number: *+86 (0) 512-8785*

Room number and office hours: *EB330; Thursday 13:00-17:00*

Preferred means of contact: Yuqing.chen@xjtlu.edu.cn

SECTION B: What you can expect from the module

- **Educational Aims of the Module**

To introduce students to fundamental electronic devices - diodes and transistors.

To show how transistors are used in amplifiers.

To introduce students to fundamental amplifiers.

To show how the electronic devices are used in amplifier and switching circuits.

- **Learning Outcomes**

A Knowledge and Understanding
On successful completion of this module, the student should;

- Understand the behaviour, important properties, equivalent circuit representations and applications of diodes and transistors;
- Understand circuit biasing, the role of decoupling capacitors and the performance of some commonly used circuit configurations and their practical significance;

- Understand amplifier circuit design and circuit analysis;

B Intellectual Abilities

On successful completion of this module the student should have be able to:

- Analyse simple transistor circuits
- Determine components to meet a specification
- Design various types of amplifiers

C Practical Skills

On successful completion of this module the student should have be able to:

- Determine device properties from characteristics
- Calculate the output voltage and regulation of simple rectifier and stabilizer circuits
- Perform simple analysis of circuits containing bipolar and MOS transistors
- Construct and test simple transistor circuits and amplifiers
- Perform simple analysis of circuits containing MOS transistors
- Construct and test simple amplifiers
- Simulate frequency response of amplifiers using LTspice.

D General Transferable Skills

On successful completion of the module, students should be able to show experience and enhancement of the following key skills:

- Independent learning
- Problem solving
- Circuit design and analysis

❑ Assessment Details

Initial Assessment

Sequence	**Method**	**Assessment Type(EXAM or CW)[2]**	**Learning outcomes assessed***(use codes under Learning Outcomes)*	**Duration**	**Week**	**% of Final Mark**	**Resit(Y/N/S)[3]**
001	Assignment	CW	A-B,D			10	S
002	Laboratory	CW	C-D			15	S
003	Mid-Term Test	EXAM	A-B,D	1 hours		15	S
004	Final Exam	EXAM	A-B,D	3 hours		60	S

Resit Assessment

Sequence	Assessment Type (EXAM or CW)	Learning outcomes assessed *(use codes under Learning Outcomes)*	Duration	Week	% of Final Mark
R001	EXAM		3 hours		100

The resit exam will assess all of the learning outcomes of the module, and will be weighted as 100% of the final module mark. Other components of the assessment, regardless of whether or not the student passed or failed, will not be included in the calculation of the final module mark, following resit examinations.

- **Methods of Learning and Teaching**

This module will be delivered by a combination of formal lectures, problem classes, class demonstrations, and case studies.

- **Syllabus & Teaching Plan**

Week number and/or date	Lecture/Seminar/Field trip/other	Topic/Theme/Title	Pre-reading
Week 1	*Lecture Tutorial*	Semiconductor Materials and Properties The pn Junction Diode Circuits: DC Analysis and Models Diode Circuits: AC Equivalent Circuit Other Diode Types Design Application: Diode Thermometer	*Chapter 1*
Week 2, 3	*Lecture Tutorial*	Diode Circuits Rectifier Circuits Zener Diode Circuits Clipper and Clamper Circuits Photodiode and LED Circuits Design Application: DC Power Supply	Chapter 2
Week 3, 4	*Lecture Tutorial*	Basic FET Amplifiers The MOSFET Amplifier Basic Transistor Amplifier Configurations The Common-Source Amplifier The Common-Drain (Source-Follower) Amplifier The Common-Gate Configuration The Three Basic Amplifier Configurations: Summary and Comparison	Chapter 2, 3
Week 5, 6	*Lecture Tutorial*	Transistor Amplifiers Basic concepts - amplifier as a system, matching Transistor as an amplifier Small signal equivalent circuit representation of a transistor Common emitter amplifier Amplifier biasing, DC operating point AC behaviour, equivalent circuit Circuit Input/Output resistances and gain	Chapter 5
Week 7	*Lecture Tutorial*	Midterm review	Chapter 1-3, 5
Week 9	*Lecture Tutorial*	The Bipolar Junction Transistor Basic Bipolar Junction Transistor DC Analysis of Transistor Circuits Basic Transistor Applications Bipolar Transistor Biasing	Chapter 4
Week 10, 11	*Lecture Tutorial*	The Field-Effect Transistor MOS Field-Effect Transistor MOSFET DC Circuit Analysis Basic MOSFET Applications: Switch, Digital Logic Gate, and Amplifier Constant-Current Biasing Multistage MOSFET Circuits Design Application: Diode Thermometer with an MOS Transistor	Chapter 6
Week 12, 13	*Lecture Tutorial*	Frequency Response Amplifier frequency response System transfer functions Bipolar transistor frequency resonance Transistor circuits frequency response	Chapter 7

Week 13	*Lecture* *Tutorial*	Output Stages and Power Amplifiers Power Amplifiers Power Transistors Classes of amplifiers Class-A power amplifiers	Chapter 8
Week 13, 14	*Lecture* *Tutorial*	Final review	Chapter 1-8

- **Reading Materials**

Required (Essential) Textbook: (eBook@XJTLU)

Title	Author	ISBN/Publisher
MICROELECTRONICS - CIRCUIT ANALYSIS AND DESIGN（4TH EDITION）	DONALD A. NEAMEN	978-007-12894

Recommended Texts:

Title	Author	ISBN/Publisher
FUNDAMENTALS OF ELECTRONIC CIRCUIT DESIGN	DAVID COMER AND DONALD COMER	JOHN WILEY
MICROELECTRONIC CIRCUITS	ADEL S. DEDRA AND KENNETH C. SMITH	OXFORD
ELECTRICAL ENGINEERING PRINCIPLES AND APPLICATIONS	ALLAN R. HAMBLEY	MCGRAWHILL
CIRCUITS DEVICES AND SYSTEMS	R J SMITH (WILEY)	MCGRAWHILL
ELECTRONIC AND ELECTRICAL ENGINEERING PRINCIPLES AND PRACTICE	LIONEL WARNES	OXFORD
FUNDAMENTALS OF ELECTRONIC CIRCUIT DESIGN	DAVID COMER AND DONALD COMER	OXFORD

Additional Readings:

SECTION C: Additional Information

- **Student Feedback**

  The University is keen to elicit student feedback to make improvements for each module in every session. It is the University policy that the preferred way of achieving this is by means of an Online Module Evaluation Questionnaire Survey. Students will be invited to complete the questionnaire survey for this module at the end of the semester.

  You are strongly advised to read the policies mentioned below very carefully, which will help you better perform in your academic studies. All the policies

and regulations related to your academic study can be found in 'Student Academic Services' section under the heading "Policies and Regulations" on E-bridge.

- **Plagiarism, Cheating, and Fabrication of Data.**
  Offences of this type can result in attendance at a University-level committee and penalties being imposed. You need to be familiar with the rules. Please see the "Academic Integrity Policy" available on e-Bridge in the 'Student Academic Services' section under the heading 'Policies and Regulations'.

- **Rules of submission for assessed coursework**
  The University has detailed rules and procedures governing the submission of assessed coursework. You need to be familiar with them. Details can be found in the "Code of Practice for Assessment" available on e-Bridge in the 'Student Academic Services' section under the heading 'Policies and Regulations'.

- **Late Submission of Assessed Coursework**
  The University attaches penalties to the late submission of assessed coursework. You need to be familiar with the University's rules. Details can be found in the "Code of Practice for Assessment" available on e-Bridge in the 'Student Academic Services' section under the heading 'Policies and Regulations'.

- **Mitigating Circumstances**
  The University is able to take into account mitigating circumstances, such as illness or personal circumstances which may have adversely affected student performance on a module. It is the student's responsibility to keep their Academic Advisor, Programme Director, or Head of Department informed of illness and other factors affecting their progress during the year and especially during the examination period. Students who believe that their performance on an examination or assessed coursework may have been impaired by illness, or other exceptional circumstances should follow the procedures set out in the "Mitigating Circumstances Policy", which can be found on e-Bridge in the 'Student Academic Services' section under the heading 'Policies and Regulations'.

- **ICE**
  Copies of lecture notes and other materials are available electronically through ICE, the University's virtual learning environment at: ICE @ XJTLU.