



Instructor:

Name: MD Rashid Hussain

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Office Hours: Tuesdays 12:00-1:00 pm, Thursdays 12:00-1:00 pm

Office: High Voltage Lab, Simrall Engineering Building

Notes on Office Hours: I warmly invite my students to engage in discussions regarding this course and any other academic inquiries or interests they might have. Email communication is favored, but in-person and virtual meetings can be arranged upon request other than office hours.

Lecture Time: T, Th 9:30 am to 10:45 am (face to face, Carpenter Engineering Building, Room 112)

Lab Times: Lab time is assigned based on the enrolled lab section in Simrall 202

Prerequisites: Grade of C or better in ECE 3421 and either ECE 3423 or ECE 3413
Grade of C or better in MA 1723, and PH 2223

Corequisites: N/A

First day of the class: Thursday, Aug 22nd, 2024

Last day of the class: Tuesday, Dec 3rd, 2024

Final Exam: Thu Dec 12th, 8:00 to 11:00 am

Textbook: *Microelectronic Circuits, Eighth Edition*, Oxford University Press, Adel S. Sedra; Kenneth C. (KC) Smith; Tony Chan Carusone; Vincent Gaudet, Publication date: November 2019, (eText ISBN: 9780190853532, 0190853530), (Mandatory)

Fall 24 Bundle ECE 3244

[https://msstate.bncollege.com/c/Microelectronic-](https://msstate.bncollege.com/c/Microelectronic-Circuits/p/MBS_4287952_dg?currentCampus=204¤tTerm=204_1_24_F¤tCourse=204_1_24_F_155_3244_1)

[Circuits/p/MBS_4287952_dg?currentCampus=204¤tTerm=204_1_24_F¤tCourse=204_1_24_F_155_3244_1](https://msstate.bncollege.com/c/Microelectronic-Circuits/p/MBS_4287952_dg?currentCampus=204¤tTerm=204_1_24_F¤tCourse=204_1_24_F_155_3244_1)

(Please purchase only the Eighth Edition of the book. It has video examples and is assigned as part of your HW.)

Reference texts: Dr. Winton's notes: Essentials of Circuits, Devices, Networks, and Microelectronics.

Laboratory Explorations to Accompany Microelectronic Circuits, 8th Edition, Vincent Gaudet; Kenneth C. Smith, eISBN-13: 9780197544877, ISBNs 9780197544877, 9780197508572, 0197544878

E-book Priced at **\$19.99** (180-day access)

[https://msstate.bncollege.com/c/Laboratory-Explorations-To-Accompany-](https://msstate.bncollege.com/c/Laboratory-Explorations-To-Accompany-Microelectronic-)
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[Circuits/p/MBS_5415684_dg?currentCampus=204¤tTerm=204_1_24_F¤tCourse=204_1_24_F_155_3244_1](https://www.msstate.edu/ce/ece/courses/ece3244/fall2024/)

- Software:** **Required** - Electronics 1 labs will use Multisim Live for circuit simulation. While the basic version is free, our complex lab circuits require the "Standard" subscription for February and March at \$2.99/month (<https://www.multisim.com/pricing/>).
Get started: Create a free "Basic" account: <https://www.multisim.com/>
Create your first Multisim Live circuit - RC filter: <https://www.multisim.com/get-started/>
Upgrade to "Standard" by sep 17th
- Hardware:** ECE 3244 tool and parts kit distributed in face-to-face lab sessions
- Website:** canvas.msstate.edu

Course Description and Objectives

(Prerequisite: Grade of C or better in ECE 3421 and either ECE 3423 or ECE 3413). Three hours lecture. Three hours laboratory. DC and small-signal models for diodes, basic principles of BJT and FET, analysis and operation of circuit models of diodes, BJTs, and FETs. Practical applications. After successfully completing this course, the students will be able to:

- i. Explain the fundamentals of semiconductors, carrier transport concepts
- ii. Explain diode circuits and design approach
- iii. Apply basic knowledge pertaining to physics of operation of diodes, FETs, and BJTs
- iv. Explain dc and small-signal models for diodes, FETs and BJTs
- v. Explain characteristics of FET and BJT configurations
- vi. Explain the design process for FET and BJT circuits
- vii. Apply basic knowledge of the frequency response of transistor amplifier circuits
- viii. Explain with amplifier characterization and classification

LECTURE TOPICS (30 contact hours)

- I. CHAPTER 3: Semiconductors
 - a. Introduction
 - b. 3.1 Intrinsic Semiconductors
 - c. 3.2 Doped Semiconductors
 - d. 3.3 Current Flow in Semiconductors
 - e. 3.4 The pn Junction
 - f. 3.5 The pn Junction with an Applied Voltage
- II. CHAPTER 4: Diodes



- a. Introduction
 - b. 4.1 The Ideal Diode
 - c. 4.2 Terminal Characteristics of Junction Diodes
 - d. 4.3 Modeling the Diode
 - e. 4.4 The Small-Signal Model
 - f. 4.5 Voltage Regulation
 - g. 4.6 Rectifier Circuits
 - h. 4.7 Other Diode Applications
- III. CHAPTER 6: Bipolar Junction Transistors (BJTs)
- a. Introduction
 - b. 6.1 Device Structure and Physical Operation
 - c. 6.2 Current–Voltage Characteristics
 - d. 6.3 BJT Circuits at DC
 - e. 6.4 Transistor Breakdown and Temperature Effects
- IV. CHAPTER 5: MOS Field-Effect Transistors (MOSFETs) 244
- a. Introduction
 - b. 5.1 Device Structure and Physical Operation
 - c. 5.2 Current–Voltage Characteristics
 - d. 5.3 MOSFET Circuits at DC
- V. CHAPTER 7: Transistor Amplifiers
- a. Introduction
 - b. 7.1 Basic Principles
 - c. 7.2 Small-Signal Operation and Models
 - d. 7.3 Basic Configurations
 - e. 7.4 Biasing

LABORATORY TOPICS (30 contact hours)

1. A review of Lab Equipment
2. Lab 1: Diode I-V Transfer Curve and Rectifiers
3. Lab 2: Diode I-V Transfer Curve and Rectifiers
4. Lab 3: Diodes Limiting and Clamping Circuits
5. Lab 4: BJT NPN IV Characteristics
6. Lab 5: BJT PNP IV Characteristics
7. Lab 6: DC Biasing of NPN BJT
8. Lab 7: Analysis of BJT in Different Configurations
9. Lab 8: NMOS I-V Characteristics
10. Lab 9: NMOS Lab 2
11. Lab 10: BJT Amplifier

- You may need to complete a few prelab activities before the beginning of each lab.
- Labs and lab reports are an essential part of the course. The laboratory portion of the course will count for about 25% of the final grade. Failure to complete the lab (this includes turning in the



lab reports) will result in a failing grade. Absence from the labs or failing to submit the lab report on time are highly discouraged.

- Labs will be performed every week. You are expected to submit the lab report every week as we progress through the course material. You are responsible for keeping track of lab reports and their due dates on Canvas. Lab reports using Multisim Live software are due in one week.
- There will be a penalty for late lab reports submission,
 - 1 or 3 days late -- 10% penalty
 - 4 to 6 days late -- 30% penalty
 - 7 to 9 days late -- 50% penalty
 - No Lab is accepted after more than 10 days late or after Dec 10

Example: you're 1 day late and get a score of 7 out of 10. After deducting 10%, your corrected score will be 6.3 out of 10.

Methods of Evaluation and Standards of Achievement

In line with the MSU attendance policy (AOP 12.09), upon enrollment, students inherently commit to full attendance and the timely completion of all coursework as directed by the instructor, applicable to both face-to-face and asynchronous learning modalities.

The computation of your final course grade will proceed according to the following criteria:

- Homework (10%)
- Class participation and Snap quizzes (7%)
- Laboratory (25%)
- Three Exams (Top two scores) (34%)
(*Online section students get 24 hours to complete the exam.*)
 - Exams I (17%), Tuesday, Sep 24th
 - Exams II (17%), Tuesday, Oct 29th
 - Exams III (17%), Tuesday, Nov 19th
- Final Exam (Thursday, Dec 12th, 8:00 to 11:00 am) (24%)
- If helpful, the final exam grade may replace the lowest exam grade.
(*This privilege applies only to those students who take all three Exams*)
- Make-up exams will be allowed for face-to-face students as per the MSU attendance policy (AOP 12.09) <https://www.policies.mssate.edu/policy/1209> or at the instructor's discretion.
- The final exam grade will automatically be substituted for a missed exam.
- Class attendance will be considered in the assignment of final grades for borderline situations.
- All dates and deadlines are subject to change at the instructor's discretion.
- Plagiarized homework from another student will result in an automatic zero for all parties involved.

University Policies



The Mississippi State University Syllabus contains all policies and procedures that are applicable to every course on campus and online. The policies in the University Syllabus describe the official policies of the University and will take precedence over those found elsewhere. It is the student's responsibility to read and be familiar with every policy. The University Syllabus may be accessed at any time on the Provost website under Faculty and Student Resources and at <https://www.provost.msstate.edu/faculty-student-resources/university-syllabus>

ECE 3244 COURSE POLICIES

Course Grading Policies

- The final course grade will be calculated with a "10-point scale":
- A = 90-100% B = 80-90% C = 70-80% D = 60-70% F = 0 - 60%
- Grades are not curved in this course! It is theoretically possible for everyone in the class to get an A (or F). Your performance depends on how well you do, not on how everyone else does. To advance in the curriculum, you must achieve a grade C (70%) or better in this course. Failure to meet these minimal criteria would leave you ill-prepared for the next level of courses.
- All class announcements, assignments will be posted on the CANVAS website. I strongly encourage everyone to use CANVAS for all class communication.
- Class attendance, participation, and snap quizzes are very important. I do expect my students to (i) attend each class, (ii) read the book and (iii) do all the homework (iv) perform each lab
- Materials provided during this course, including but not limited to the syllabus, lecture notes, class handouts, homework assignments and solutions, lab manuals, and digital presentations, represent the intellectual property of the instructor and the ECE department at MSU. Unauthorized sharing, publishing, or quoting of these materials is strictly prohibited without prior written consent from the instructor. Your respect for and adherence to this policy is greatly appreciated.

Assignment Submissions

- Throughout this course, **multiple homework** (HW) assignments will be given on a weekly basis. You are responsible for keeping track of these assignments and their respective due dates on Canvas. Please be aware that late submissions will not be accepted.
- Homework should primarily be **handwritten**, using traditional or digital pens/pencils, unless the task requires clearly computer-generated output, such as plots or simulation results. Please ensure all submissions are single-sided, either written on US letter-size paper or drafted with an



electronic pen. It is crucial to submit your responses in numerical order and clearly write your name, class number, and assignment number on the first page of your submission.

- If you lack access to a scanner, there's no need for concern. You can transform your smartphone or tablet into an intelligent document scanner by utilizing apps such as GeniusScan (<https://thegrizzlylabs.com/genius-scan/>) and CamScanner (<https://www.camscanner.com/>).
- A primary objective of this course is to polish your technical report-writing skills. Remember, correct answers alone will not earn you full credit. The process of arriving at your answer, including the principles applied and steps followed, must be clearly documented. Effectively documenting and explaining your work to other professionals is paramount.
- Unless stated otherwise, all assignment deadlines are set for **11:59 pm**. Homework must be submitted online via Canvas on the specified due date. To submit your work, you'll need to create a PDF of your completed assignment and save it to your computer prior to submission.
- While collaboration is encouraged, the work you submit must be your own. Parallels between your submission and others' should be minimal. Regardless of collaborative efforts, you must prove to the grader that your submission is not a mere replication of another's work. Submissions that are excessively similar will result in a zero grade for all involved parties and a report of academic misconduct will be filed with the MSU Honor Council.

Attendance Policies

Please refer Academic Operating policy 12.09. (<http://www.policies.msstate.edu/policypdfs/1209.pdf> Links to an external site.), regarding attendance expectations and accommodations. Note that official, university-approved and documented absences are not subjected to attendance penalties. It is the student's responsibility to initiate a request of making up course work in a timely manner. Unless impractical, all communication regarding official, university-approved and documented absences and make-up work should take place prior to the absence.

AI Policy: Permitted for Select Assignments in this Course with Attribution

Generally, students are **NOT** permitted to use generative AI tools such as ChatGPT for assignments except those authorized specifically by their instructor in the assignment directions. The unauthorized use of a generative AI tool to complete an assignment constitutes academic dishonesty and may be reported as an Honor Code violation. All submitted work will be filtered through Turnitin's AI writing detection tool, and other screeners may also be used.

For assignments in which generative AI has been explicitly permitted by your instructor, students must give credit and cite any AI-generated material according to citation-specific rules (e.g., IEEE style), including in-text citations, quotations, and references. Any work with more than the allowable percentage of AI-generated material specified in the assignment instructions, if applicable, could be reported as an



Honor Code violation. Students must also include the following statement in assignments to indicate use of a generative AI tool: “The author(s) acknowledges the use of [Tool Name] in the preparation of this assignment for [brainstorming, grammatical correction, citation, etc.]” Failure to acknowledge use of generative AI could be reported as an Honor Code violation.

Expectations for the ECE 3244 Classroom and Communication

The following policies for course communication apply for **ALL students**:

- You are required to check your MSU email account regularly. This is considered an official means of communication by MSU for all students.
 - The course materials for each week will be accessed through Canvas beginning on Mondays.
 - Assignment submissions including quizzes will utilize Canvas unless otherwise specified by the instructor.
 - You are required to have access to a computer that connects to the internet.
 - Students should direct correspondence to the instructor directly related to the class via the mail feature in Canvas.
 - Students should not discuss specific quiz questions.
 - Students are encouraged to discuss homework together in a group, but the assignment should be completed individually.
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Minimum Technology Requirements

The following minimum technology requirements are necessary **for all students** to complete the course:

- Computer with web browser, Microsoft Office, and Adobe Reader
- Internet access
- Webcam and microphone (computer or smartphone) to upload video responses to assignments or participate in virtual meetings / office hours.
- Video recording and editing software (Camtasia is available to download free from MSU ITS)

Technical Assistance

If you have questions about this course, please contact the instructor via Canvas messaging. For technical support (e.g., computer support, Canvas issues), please contact help@ece.msstate.edu or enr-dist-support@lists.msstate.edu or www.bagley.msstate.edu/distance.



Copyright

Copyrighted materials within the course are only for the use of students enrolled in the course for purposes associated with this course and may not be retained or further disseminated. Course materials must not be posted on any website or added to any database without the instructor's written permission. Do not distribute test problems, homework, or any other materials. Do not post course materials on websites such as chegg.com, slader.com, etc. Violations of this policy will be referred to the Honor Court.

Tentative Schedule

<u>Week</u>	<u>Date</u>	<u>Topic / Event</u>
1	Aug. 22	A quick review of ECE 3413 /3423 (Circuits I)
2	Aug. 27 Aug. 29	Semiconductors. Semiconductors
3	Sep. 3 Sep. 5	Semiconductors Semiconductors
4	Sep. 10 Sep. 12	Diodes Diodes
5	Sep. 17 Sep. 19	Diodes Diodes
6	Sep. 24 Sep. 26	Exams I Diodes
7	Oct. 1 Oct 3	Bipolar Junction Transistors (BJTs) Bipolar Junction Transistors (BJTs)
8	Oct. 8 Oct. 10	Bipolar Junction Transistors (BJTs) Fall break (No Class)
9	Oct. 15 Oct. 17	Bipolar Junction Transistors (BJTs) Bipolar Junction Transistors (BJTs)
10	Oct. 22 Oct. 24	Bipolar Junction Transistors (BJTs) MOS Field-Effect Transistors (MOSFETs)
11	Oct. 29 Oct. 31	Exams II No Class



12	Nov.	5	MOS Field-Effect Transistors (MOSFETs)
	Nov.	27	MOS Field-Effect Transistors (MOSFETs)
13	Nov.	12	MOS Field-Effect Transistors (MOSFETs)
	Nov.	14	MOS Field-Effect Transistors (MOSFETs)
14	Nov.	19	Exams III
	Nov.	21	Transistor Amplifiers
15	Nov.	26	Transistor Amplifiers
	Nov.	28	No Class
16	Dec.	3	Course Review

Exam Wk Dec 12th Final exam