

## Course Syllabus

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### Course Information

EERF 6393.001 Microwave Power Amplifiers

Spring 2024

Monday and Wednesday: 10:00am-11:15am ECSW 3.250

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### Instructor Contact Information

Dr. Matt Heins

Office: ECSN 4.608

Phone: 972-883-3846

Email: [Matthew.Heins@utdallas.edu](mailto:Matthew.Heins@utdallas.edu)

Office Hours: TBD or by appointment (please send me an e-mail to propose a time)

TA Contact information: Will be posted in e-learning when available

Please use either your e-mail or Teams, using your UT Dallas credentials for communication with the instructor and teaching assistants.

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### Course Pre-requisites, Co-requisites, and/or Other Restrictions

Pre-requisite: EERF 6311 RF and Microwave Circuits (or equivalent) is required.

Co-requisite: EERF 6355 RF and Microwave Amplifier Design (completion or concurrent registration is required)

Familiarity with microwave CAD tools (NI Microwave Office or Keysight ADS) is required.

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### Course Description

RF/Microwave transistor power amplifier (PA) applications and key requirements such as output power, efficiency, and linearity are studied. Aspects of a comprehensive design procedure are studied including: device technology and modeling, amplifier topology selection, biasing, linear/non-linear analysis and stability. Students will complete projects to demonstrate mastery of design procedures including CAD techniques.

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### Student Learning Objectives/Outcomes

- Ability to understand and analyze RF and microwave power amplifier applications, requirements, and characterization methods.
  - Ability to understand transistor technologies, modeling, and characterization for power amplifier design.
  - Ability to understand and demonstrate RF power amplifier design techniques needed to satisfy key performance objectives.
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### **Recommended Reference Books**

*RF Power Amplifiers for Wireless Communications*, 2<sup>nd</sup> Ed., Steve C. Cripps, Artech House, 2006

*Fundamentals of RF and Microwave Transistor Amplifiers*, Inder J. Bahl, Wiley, 2009

*RF and Microwave Power Amplifier Design*, 2<sup>nd</sup> Ed., Andrei Grebennikov, McGraw-Hill, 2015

*Microwave Engineering*, 3rd Ed., David M. Pozar, Wiley, 2005

### **Suggested Course Materials**

Compass and straightedge for Smith Chart analysis

### **Required Technology**

Students should have the following:

- Electronic device capable of accessing E-learning/MS Teams  
Microphone/speakers/camera recommended.
- PC Laptop or equivalent capable of running Microwave Office design software
- Application or hardware to scan handwritten homework/quiz/exam papers and convert to .pdf format
- Word processing software (Word/Google Docs, ..etc).

See OIT <https://www.utdallas.edu/oit/o365/> page for Office 365 software provided to students including Teams.

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## **Assignments & Academic Calendar**

### **Course Outline**

Power Amplifier Applications, Characteristics, and Design Fundamentals

- Key applications in modern systems
- PA definitions and key characteristics
- Load-line analysis and amplifier classes

Transistor Technology and Modeling

- Transistor technologies: FET and Bipolar
- Small-signal and large-signal modeling
- Load-pull measurements

Amplifier Topology Selection and Design

- Matching network implementation
- Biasing techniques
- Power combining
- Thermal analysis
- Considerations for efficiency
- Considerations for linearity

Design Analysis

- Linear analysis using S-parameters

- Non-linear analysis
- Stability analysis

Note: Course content is subject to change. Attendance in lectures is required.

**Grading Policy** (Subject to change)

Quizzes/Homework: 10 %

Projects: 35 %

Exam 1: 25 %

Exam 2: 30 %

Exam 1 and 2 dates will be announced at least 1 week prior to the exam.

Students have one week after quiz, exam, or project grades are posted to request a review with the instructor. After one week no grading changes are allowed.

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**Course & Instructor Policies**

Design Projects:

The course will include design projects that require written reports and possibly a class presentation. Projects will require use of microwave CAD tools (MWO or ADS).

Make-up Exams:

Make-up quiz or exams will be scheduled for students with university-approved absences. Other absences must be approved in advance by the instructor.

Late Work:

Late work is not accepted without special circumstance and pre-approval by the instructor

Extra Credit:

No extra credit or make-up exams will be given to improve scores

Class Citizenship:

Student participation is expected. Students are prohibited from communicating with others during quizzes and exams. Students are expected to communicate in a professional manner during all course activities.

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## **Class Materials**

The instructor may provide class materials that will be made available to all students registered for this class as they are intended to supplement the classroom experience. These materials may be downloaded during the course, however, these materials are for registered students' use only. Classroom materials may not be reproduced or shared with those not in class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

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## **Class Attendance and Class Participation**

Regular class participation is expected. Students who fail to participate in class regularly are inviting scholastic difficulty. A portion of the grade for this course is directly tied to your participation in this class. It also includes engaging in group or other activities during class that solicit your feedback on homework assignments, readings, or materials covered in the lectures (and/or labs). Class participation is documented by faculty. Successful participation is defined as consistently adhering to University requirements, as presented in this syllabus. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

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## **Class Recordings**

Students are expected to follow appropriate University policies and maintain the security of passwords used to access recorded lectures. Unless the Office of Student AccessAbility has approved the student to record the instruction, students are expressly prohibited from recording any part of this course. Recordings may not be published, reproduced, or shared with those not in the class, or uploaded to other online environments except to implement an approved Office of Student AccessAbility accommodation. Failure to comply with these University requirements is a violation of the [Student Code of Conduct](#).

The instructor may record meetings of this course. These recordings will be made available to all students registered for this class if the intent is to supplement the classroom experience. If the instructor or a UTD school/department/office plans any other uses for the recordings, consent of the students identifiable in the recordings is required prior to such use unless an exception is allowed by law.

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## **Comet Creed**

*This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:*

“As a Comet, I pledge honesty, integrity, and service in all that I do.”

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## **Academic Support Resources**

The information contained in the following link lists the University’s academic support resources for all students.

Please see <http://go.utdallas.edu/academic-support-resources>.

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## **UT Dallas Syllabus Policies and Procedures**

The information contained in the following link constitutes the University’s policies and procedures segment of the course syllabus. Please review the catalog sections regarding the [credit/no credit](#) or [pass/fail](#) grading option and withdrawal from class.

Please go to <http://go.utdallas.edu/syllabus-policies> for these policies.

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*The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.*