



Course Brief and Outline—2018

Academic Staff:

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1 Course Background and Purpose

The course is structured as CESM 080901: Electrical, Electronic and Communications Engineering. Antennas form a vital link between transmitters (receivers) and the propagation medium. As such they perform as electromagnetic transducers by converting current and voltage into E and H fields and vice versa. (Forgetting this leads to the iPhone4 fiasco!)

The main aim of lectures is to convey some experience, insight and intuition as well as to stimulate discussion.

The sudden interest in all things “Wireless” was first ushered in by the phenomenal success of GSM. The trend is towards 3G UMTS, WCDMA, Wireless EtherNet (Wi-Fi), Wireless Broadband, WiMax, 4G LTE, 5G etc.

Although from a DataComms perspective, we are simply the “air-interface” it is a very misunderstood area: I get weekly calls about terrible effects of cellphone base stations :-). Yes, the protocol used can squeeze more bits into a channel, but it is ultimately the antenna (system) that determines the interface to the medium.

Collecting fancy pictures from Mars depends rather heavily on the “intelligence” of the antenna system; getting them from the end of the solar system is nothing short of an engineering miracle!

2 Course Outcomes

On successful completion of this course, the student is capable of:

1. understanding antenna terminology and fundamental characteristics.
2. using antenna simulation programs effectively.
3. designing and understanding the operation of some common antenna types.
4. performing basic electromagnetic derivations on simple antenna types.
5. performing some basic antenna measurements.

3 Exit-Level Outcomes (ELO's)

In keeping with the course being offered as an Elective in the Fourth year-of-study, the ELO's are common with all Elective courses. The ELO's are Assessed at exit-level, ie are ELA's.

- ELO 1** *Problem Solving.* The examination consists of under- and over-specified problems to be solved in a creative manner.
- ELO 2** *Application of Knowledge.* Uses mathematics, physics and basic engineering science in an integrative manner.
- ELO 5** *Methods, Skills and Tools.* Requires the use of specialised analysis software for Antenna Design, specifically SUPERNEC, XNec2, 4NEC, FEKO, etc.
- ELO 6** *Professional and Technical Communication.* Proper Technical reports are assessed for both the Project and Laboratory.
- ELO 9** *Independent Learning.* The Project is specifically aimed at un-lectured material, and is an independent design.

4 Course Content

The content of this course is as per *Rules & Syllabuses: Faculty of Engineering and the Built Environment*.

5 Prior Knowledge Assumed

The prerequisites and corequisites for this course are as per *Rules & Syllabuses: Faculty of Engineering and the Built Environment*.

6 Assessment

All submissions must be in strict accordance with the guidelines contained in the *School's Blue Book* and the rules contained in the *School's Red Book*. No exceptions will be considered.

6.1 Components of the Assessment

This is described in the School's document entitled *Application of Rule G.13 and Calculator Requirements* on the School notice board.

The examination will cover *all* material covered in the course, and especially discussion topics in lectures.

6.2 Assessment Criteria

The student's understanding of the fundamental aspects of the course will be probed. Exam questions etc will need to be answered in order to answer the question: "WHY?" as opposed to the simplistic "HOW". I am not attempting to assess a simple methodology, I will assess fundamental understanding of concepts.

Note that the onus is upon the student to convey this understanding in an examination. A terse, correct "answer" may not necessarily attract marks! Please refer to my exam writing skills notes at ytdp.ee.wits.ac.za/ExamWritingSkills.html.

6.3 Satisfactory Performance (SP) Requirements

Rule G.13 and the School's documents entitled *Application of Rule G.13 and Calculator Requirements* and the *School's Red Book* (see the School notice board) apply.

In addition, the successful completion of the laboratory and project assignments are SP requirements.

6.4 Calculators in Examinations

See the School's document entitled *Application of Rule G.13 and Calculator Requirements* on the School notice board.

7 Teaching and Learning Process

7.1 Teaching and Learning Approach

My lecturing style is highly interactive, and largely of the “chalk and talk” variety. This means that the emphasis during lectures is upon understanding, and not on “transferring the lecturer’s notes to those of the student, without passing through the minds of either”. Interaction on the part of the student is *required*.

One negative consequence of an interactive lecturing style (as opposed to a transfer of notes style), is that the student actually gains *an* understanding in the lecture. If it assumed that this *initial* understanding is all that is required, disaster occurs. Learning is an *iterative* exercise, and requires constant re-inforcement. My lecturing style can thus lead to a complacency which is rudely interrupted at examination time. **HENCE:**

Tutorial exercises are designed to complement and probe material *currently being taught*. They are *not* necessarily designed as examination questions, which typically cover more comprehensive, integrated material. Doing these tutorial exercises only just before the exams will not help. They are to be done concurrently with the material being explored. The past exam papers are to be used as a benchmark for examination questions.

7.2 Arrangements

Lectures:

There will be two lectures per week. Students are expected to attend all lectures and to make their own notes.

I keep strictly to South African Standard Time (SAST). I respect your time, and will not drag on my lectures, and I expect you to respect my time, and that of your colleagues, by arriving on time, so that latecomer disruption is avoided.

Tutorials:

There will also be a tutorial by arrangement only.

Project:

In common with all fourth year courses in the “Honours” year, there will be a project—see handout, deadline as per 4th year schedule.

Laboratory:

There will be a laboratory associated with this course with a booking sheet posted later. The laboratory is felt to be an extremely important part of this course: hence the assessment rating. A thorough and properly presented report is expected. Students who cannot produce evidence of preparation will be asked to leave the laboratory.

School Policy states that there are no lab exemptions.

Consultation:

I have what I call a “Modified Open Door” policy. You can come and see me at any time, but only in groups! I have a great regard for the peer-support system; you only really understand something if you can explain it to your peers. I have long ago forgotten the particular difficulties I had with some of the concepts taught in this course, they now appear to me as “obvious”; peers do not have this myopia.

The preferred method of contact, however, is email.

It is generally convenient to grab me between and after lectures.

8 Information to Support the Course

8.1 Prescribed Text/Reading

There is a prescribed text for this course, the same as was used for the Electromagnetics course.

There are no notes handed out for this course.

In addition, there is a 122 page “Study Guide”, by some obscure bloke:

- Clark A. R. (2004) “SUPERNEC Study Guide for Electromagnetics and Antennas”, Poynting Innovations, Wynberg, Sandton.

available from the Course Home Page. (See below).

8.2 Other References

- Kraus JD (1988) Antennas (2nd ed.) McGraw-Hill.
- Collins, RE (1985) Antennas and radiowave Propagation. McGraw-Hill.
- Jordan EC and Balmain KG (1968) Electromagnetic Waves and Radiating Systems. Prentice-Hall.
- Balanis CA(1982) Antenna Theory—Analysis and Design. Harper and Row
- Stutzman WL and Thiele GA, (1981) Antenna Thoery and Design. John Wiley and Sons.
- Hall GL (ed) (yearly publication) The ARRL Antenna Book, American Radio Relay League.

8.3 Course Home Page

For other information related to the course, please refer to the Course Home page at <http://ytdp.ee.wits.ac.za/elen4001Home.html>

9 Other Information

Although the University Senate has ruled that attendance at lectures is not compulsory, lectures will be used to *supplement* course texts, and this supplementary information *will* be examinable. Announcements relating to the course will also be made in lectures from time to time.

The Fourth Year notice board may be used for any course announcements.

The Wits eLearning platform (a.k.a. SAKAI) will be the official announcement medium.

The online version is <http://ytdp.ee.wits.ac.za/elen4001outline.html>