Universidad de Puerto Rico
Recinto Universitario de Mayagüez

Departamento de Ingeniería Eléctrica y Computadoras

SYLLABUS: INEL 6669 MICROWAVE REMOTE SENSING

Off. Hrs. 7:30 –8 am LMV (To be Determined)

Description: This course deals with the interaction of electromagnetic waves with natural (clouds, rain, snow) and artificial targets. In addition, it provides with an introduction to radiometry principles (e.g. Planck's Law) and to active and passive instrumentation used in remote sensing such as radiometers, radars and altimeters, with emphasis on passive systems. Prerequisites: Electromagnetics II.

Text: Professor's notes online http://ece.uprm.edu/~pol/6669 and Ulaby, F. T. and Long, D. G. **Microwave Radar and Radiometric Remote Sensing** (2014) and http://mrs.eecs.umich.edu/

Course Topics Outline:

TOPICS	# of lectures	Assigned problems
Introduction to microwave remote sensing including the electromagnetic spectrum, and brief history. CH. 1	2	-
Electromagnetic waves Propagation CH. 2	3	1-3,5,7,9,13,16,17,24,26,28, 32,36, 37,40,42, 43
Remote Sensing Antennas CH. 3	3	1-4,7-9, 11-13, 15-22,28-30,32-34, 36-42
Dielectric Properties of Natural Materials Ch 4	2	-
Radiometry theory: thermal radiation, Black body radiation – Planck's Law, Radiative Transfer Equation, Apparent temperature, Emission and reflection CH. 6	15	**Ch 6, Probl. 1, 2, 4, 5, 5, 7, 8**
Radiometer systems: Noise temperature, Noise figure, Noise in cascade systems, various types of radiometers (e.g Dicke) CH. 7	7	Ch 7. Probl. 1, 2, 4-6
Microwave interaction with Atmospheric constituents: physical properties of atmosphere, absorption and emission by gases, extinction due to clouds, rain, snow. CH. 8	10	Ch8. Prob.1, 2 (for 2 km), 3 (for 2km),4(25km), 5(for 307 K, and 35 **g/m3** of **water vapor**), 6 (Use To-307K), 7,8,11,14,16, 17(ρ_o= 35 g/m3)
**TIME permitting, we'll add extra material about weather radars, radar reflectivity and/or inversion techniques	-	

EVALUATION:

1 Partial Exams 15% each], Feb 14, ~~Mar 30~~ During class period.
Projects 25%
Quizzes and Homework [25%+15%]= 40%,
Final Exam[@ 20%] = 100%

REFERENCES:

1 **Ulaby, F.T., R.K. Moore, and A.K.Fung, Microwave Remote Sensing: Active and Passive, Vol. 1, Addison-Wesley (1986).**
2 **Introduction to Microwave Remote Sensing** by Iain H. Woodhouse (2004)
3 **An Introduction to Ocean Remote Sensing** by Seelye Martin (2004)
4 **Passive Microwave Remote Sensing of the Earth**: Physical Foundations (Springer Praxis Books / Geophysical Sciences) Eugene A. Sharkov (2004)
5 **Microwave Dielectric Behaviour of Wet Soils** by Jitendra Behari (Kindle, 2005)
6 **IEEE Transactions on Geoscience and Remote Sensing** *(available online from UPRM library)*
7 **Impact of clouds on microwave remote sensing** by T. R. Sreerekha (2005)

Fine Print **There might be changes to the above syllabus. In that case, changes will be notified to the students in class or via email. Students are responsible for knowing any changes. **