Space Hardware

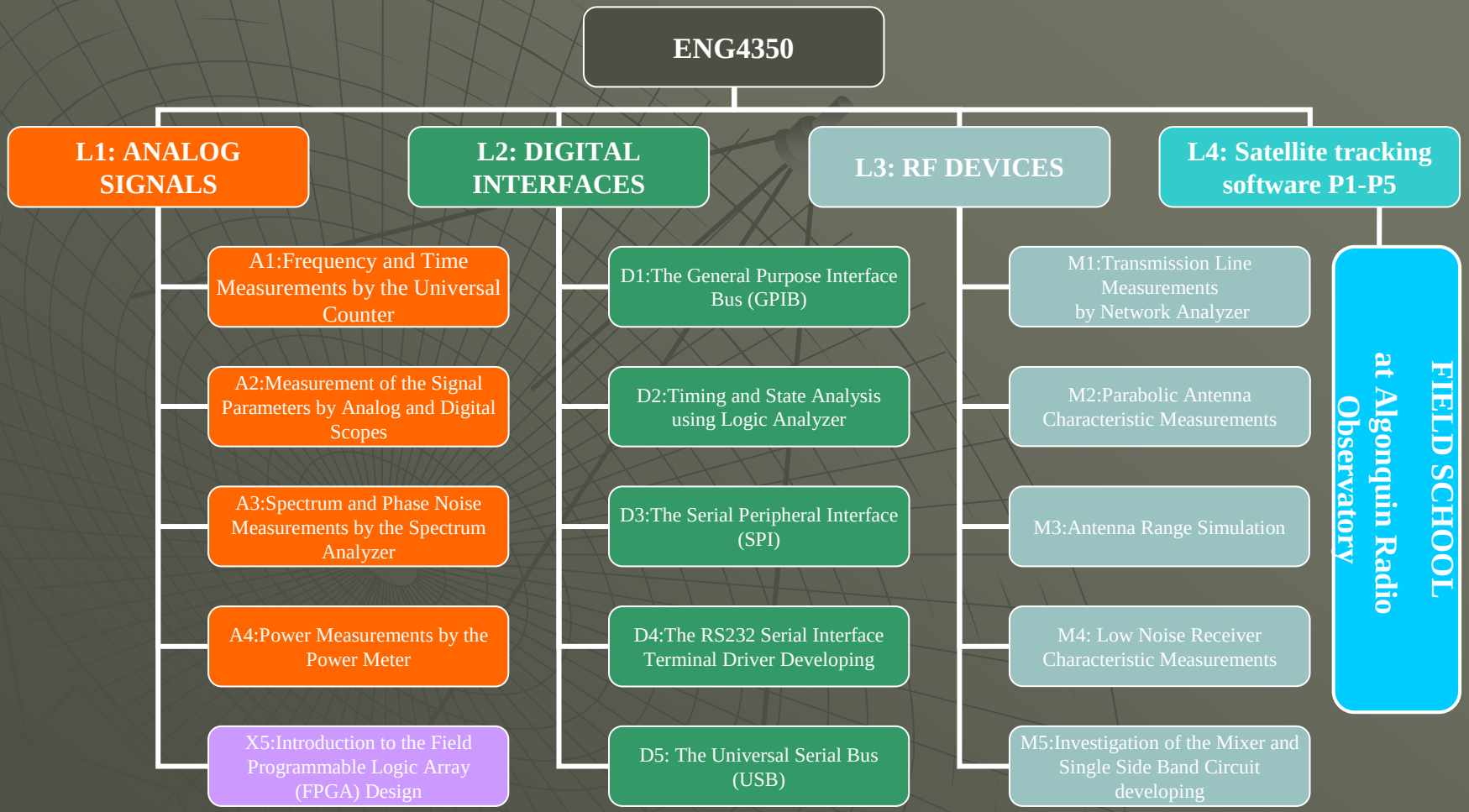
ENG 4350

H. Chesser – CSE 1012U

Course Overview

- Context – spacecraft communications, ground station equipment
- Links/applies/integrates theoretical concepts from a number of courses:
  - PHYS 3050, 3150 - Electronics I&II
  - PHYS 3250, 4250 – Space Communications, Signal and Communications Theory
- Introduces you to some commonly used test equipment
- Develops software writing skills – VHDL, LabView and Matlab
- All classes and labs given in the undergraduate space engineering lab (PSE 315)

Lab Organization



Course Syllabus

- Course is divided into 4 sections, each 6 weeks long
- Each section consists of
  - 5 labs, students perform one lab per week
  - 10 lectures, 2 each week – 2 Assignments
  - Quiz/Demo at the end
- Labs are done in groups of max 3 students
- Each lab has questions/problems to be answered and submitted each week
- At the end of the lab set, we'll have a quiz
- Radio license tests (Basic and Advanced)
- The final set of labs will culminate in a trip to ARO to demo software (instead of quiz)

Typical Schedule (Fall 09)

DATE	TIME	LECTURE TOPIC	Assignment
7-Sep 11-Sep	No Class 10:00-11:30	Intro to Course, Analog Labs, Signal Classification	
14-Sep 18-Sep	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: dB, Frequency Domain, Lab: Analog Session #1 Lecture: Fourier Transform, AM, FM	
21-Sep 25-Sep	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: AM, FM, Frequency Bands, Lab: Analog Session #2 Lecture: Aliasing, Electrical Basics	Assignment A1 due
28-Sep 2-Oct	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: Electrical Basics, Lab: Analog Session #3 Lecture: Semiconductor Review	
5-Oct 9-Oct	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: Radio Circuits, Lab: Analog Session #4 Lecture: Radio Circuits	Assignment A2 due
12-Oct 16-Oct	Fall Reading Week	No Classes or Lab	
19-Oct 23-Oct	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: Canadian Radio regs, Lab: Analog Session #5 **Analog Lab Quiz**	
26-Oct 30-Oct	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: LabView Programming, Lab: Digital Session #1	
2-Nov 6-Nov	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: Digital Session #2	Assignment D1 due
9-Nov 13-Nov	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: Digital Session #3 Digital Protocols – RS232, USB	
16-Nov 20-Nov	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: Digital Session #4	
23-Nov 27-Nov	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: Digital Session #5 Digital Data via Radio – AX.25, RTTY	Assignment D2 due
30-Nov 4-Dec	10:00-11:30, 15:30-18:30 No Class	**Digital Lab Quiz**	

Typical Schedule (Winter 10)

DATE	TIME	LECTURE TOPIC	Assignment
4-Jan 8-Jan	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: RF Device Session #1 Intro to RF Device Labs	
11-Jan 15-Jan	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: RF Device Session #2 Antennas	Assignment M1 due
18-Jan 22-Jan	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: RF Device Session #3	
25-Jan 29-Jan	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: RF Device Session #4	
1-Feb 5-Feb	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: RF Device Session #5	Assignment M2 due
8-Feb 12-Feb	10:00-11:30, 15:30-18:30 10:00-11:30	**RF Device Quiz** **(Basic Radio Operator's Exam)**	
15-Feb 19-Feb	Reading Week	No Classes, Lab	
22-Feb 26-Feb	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: Tracking Session #1 Intro to Tracking Labs, STK	
1-Mar 5-Mar	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: Tracking Session #2	Assignment P1 due
8-Mar 12-Mar	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: Tracking Session #3	
15-Mar 19-Mar	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: Tracking Session #4 Link Budget	
22-Mar 26-Mar	10:00-11:30, 15:30-18:30 10:00-11:30	Lecture: , Lab: Tracking Session #5	
29-Mar 2-Apr	10:00-11:30, 15:30-18:30 Good Friday	Tracking Test with Small Dish	Assignment P2 due
5-Apr 9-Apr	10:00-11:30, 15:30-18:30 No Class	**Advanced Radio Test**	

Field Trip Schedule

- **Final group of labs culminates in a 4-day field trip to the Algonquin Radio Observatory (ARO) to track a GPS satellite using software which you have written**
- **ARO is currently fully operational (azimuth drive fixed over the summer)**
- **Please do not commit to any activity in the two weeks following exams**

Course Texts, References

- Lab Manual – available on course web site
- Steacie Reserve:
  - "Labview 8 Student Edition", Bishop, Robert, (includes student edition CD), Q 185 B5575 2007
  - "Electronic Test Instruments", R.A.Witte, 2002, Second edition, TK 7878.4 W 593 2002
- Other references:
  - *Microelectronic Circuits 5th ed*, Sedra, Smith, TK 7867 S39 2004 BOOK
  - "Satellite Communications", Roddy, Dennis, Third edition, TK 5104 R627 2001
  - "Signals and Systems", Haykin, S., VanVeen, B., 2003, TK 5102.5 H37 2003
  - "Analog and Digital Communication Systems", Roden, M.S., 1996, TK 5105 R64 1996

Assignments

- Questions on lab performed (weekly, due on Monday before lab session)
- Assignments based on lecture material
- All assignments and questions done individually (Exception: Software Project – done as a group)
- DO NOT copy question responses

Marks

- Marks will be given for each of the 4 segments of the course (Analog, Digital, RF Devices, Tracking) – each segment is equally weighted for the final course mark
- For each segment, marks are determined as follows:

Activity	Totals
Lab Questions	40%
Class Assignments	30%
Quizzes, ARO Demo	30%

Use of Moodle

- Lab manual will be posted to web site – during lab period. Either:
  - Print out lab exercise before coming to the lab
  - Access lab exercise using a laptop and AirYork or lab computers
- Lectures, schedule, announcements will also be posted to the Moodle site
- Access site using a browser - moodle.yorku.ca
- Use your Passport York username and password to log in
- IMPORTANT: Ensure your Moodle profile uses an e-mail address that you check frequently