

**This is a sample syllabus only.
The instructor may make changes to the syllabus in future courses.**

**EYE MOVEMENTS
AND
PRINCIPLES OF BINOCULAR VISION**

VS 132 – VS 132 LAB

SUMMER 2017

Web site: <http://www.emrl.uab.edu>

Instructor (eye movement section) and course master: Dr. Claudio Busettoni

Phone: 934-2601

e-mail: cbus@uab.edu

Office address: 612 Worrell Building
924 18th St South

Office hours: By appointment

Instructor (binocular vision section): Dr. Lei Liu

Phone: 996-6627

e-mail: liul7788@uab.edu

Office address: 502 Henry Peters Building
1716 University Boulevard

Office hours: By appointment

General information and required statements

- Classes will be in HPB room 203 (with the ongoing HPB renovations the location may vary)
- Busettini lab sessions will be in the VOR Clinic (HPB Pediatric Clinic) and Worrell room 402 (from the elevator to the left)
- Liu lab sessions will be in HPB room 305

Tests: multiple choice (four tests)

25% of grade = Test # 1 (Liu section)

20% of grade = Test # 2 (Busettini)

20% of grade = Test # 3 (Busettini)

15% of grade = Laboratory reports (Busettini lab only), to be returned to Busettini at the beginning of the final test. See note below.

20% of grade = Test # 4 - final (Busettini)

Participation to the lab sessions (4 hours with Busettini, 2 hours with Liu) is required to pass the course.

Grading: 90-100 : A

80-89 : B

70-79 : C

Below 70 : fail

Auditing the course is welcome, with the SO professional student following the rules established by the School of Optometry regarding auditing and the decisions of the Professional Program Academic and Honor Council. Auditing students can take the tests for self-evaluation even when not required by the Professional Program Academic and Honor Council to do so. Auditing is also allowed to students outside the SO Professional Program.

Students are required to know and to follow the School of Optometry Honor Code and the academic policies described in the UAB Student Handbook. Any case of academic misconduct will be reported to the School of Optometry Professional Program Academic and Honor Council. Students are also

required to know and to follow the UAB non-academic conduct policy (<http://www.uab.edu/studentconduct>).

Please turn off cell phones during class (laptops, tablets are allowed for note taking) and, of course, turn off everything during tests. Video recording of the lesson and taking pictures of the blackboard are allowed.

Although it is a home assignment, the report associated with Dr. Busettini laboratory sessions is an actual test and evaluated the same way and with the same weight of classroom tests. Each student has to develop his/her report independently. Evident collaborations will result in a F grade and report to the School of Optometry Professional Program Academic and Honor Council.

If you are registered with Disability Support Services, please make an appointment with Dr. Busettini and Dr. Liu as soon as possible to discuss accommodations that you are requesting. If you have a disability but have not contacted DSS, please call 934-4205 or visit DSS at 409 Hill University Center. Students with disabilities must be registered with DSS and provide an accommodation request letter from DSS to the course master before they can receive accommodation/academic adjustments.

This module/course is intended to give students the knowledge, skills, and attributes needed of an entry-to-practice Doctor of Optometry. While this module/course should also help students prepare for licensing examinations such as those administered by the NBEO, nothing in this module/course, including the lectures and discussions, coursework, study guides, teaching notes, electronically posted information, or other materials, should be believed or understood to utilize actual confidential examination items from licensing examinations. For example, throughout this module/course, the instructor(s) may indicate points of emphasis for NBEO study and preparatory work. This instructional approach does not reflect knowledge of actual NBEO examination items, but represents a suggested area of focus based entirely upon the NBEO content outline/matrix. All materials in this module/course have been prepared in good faith to comply with the highest ethical standards of the profession.

The course

The main goal of this course is to give to you the basic anatomical and physiological knowledge of eye movements and binocular vision needed to correctly interpret the most common clinical cases you will encounter in your practice. This knowledge will also be needed to follow the specialized clinical courses on pathologies of eye movements and of binocular vision that are part of your clinical curriculum. Although this is not a clinical course, we will analyze several clinical examples.

Liu will start first (8 hours), covering the main physiological and functional properties of normal binocular vision and the typical measures used to quantify it.

Busetini (28 hours) will show how binocular vision translates in terms of eye movement organization. He will then describe the neural circuitry driving the extraocular muscles, a circuitry that is shared by all oculomotor systems (final common pathway). The anatomical, physiological, and functional properties of the various oculomotor systems will then follow.

This is an intense and quite complex course, particularly for first year students. Attendance is a key element for this course. Classes include demonstrations, presentation of supplementary material, and discussion of student questions of general interest. We will do our best to accommodate any reasonable special request, like time and date of tests, absence for special events, and so on. In case of prolonged sickness or other issues significantly affecting class attendance by a student, we are available to work with the student in compensating for the time lost. If you feel that you are falling behind on some parts of the course, do NOT wait the day of the test to ask for help, or AFTER the poor grade! Feel free to interrupt us ANYTIME for questions or clarifications. If you want to meet one of us in person, please e-mail or call first. We are often in our laboratories running experiments.

In case the final grade is I (incomplete) or F (fail), the course master will discuss with the student, the UABSO Professional Program Academic and Honor Council, and Student Affairs about the best approach to take in the specific case. The Academic Policy for the First Professional Degree Program developed by the SO Professional Program Academic and Honor Council will be used as guideline.

All class material is offered as paper handouts and online before it is discussed in class. To save paper and toner, before the first class the course master will e-mail class to ask how many students want to have paper copies. On the web pages there are also videos together with old tests (with answers and comments) from the previous years for self-testing. It is strongly suggested that you use this self-testing possibility, where also each question is discussed in details. Login and password to access this material are given at the first class. The material is still on the Linux laboratory web page system, but a transition to Canvas is planned not too far in the future. No optometric items are required for this course.

As all courses, it is always a work in progress. The class evaluation of the course is an important tool for us to understand our strengths and weaknesses. Please help us with constructive comments and suggestions, which are also welcome ANYTIME during the course, in class or “off the record”. As indicated below, UAB SO student rules require that you evaluate all the courses you have taken.

UAB School of Optometry Student Evaluation of Teaching (SET):

It is important that students be given the opportunity to offer constructive feedback on content, delivery, organization, and other aspects of the teaching and learning environment for this course. The intent is to improve the course for those students who will follow. By responding to the questions in the SET evaluation, students are actively participating in the governance of the School of Optometry and in the continuous improvement of its professional curriculum. Because of the importance placed on these SET evaluations, online submission of the SETs is a requirement for successful completion of this course.

There is no recommended text, the material presented in the course being from different books and journal articles. For further readings:

S.B. Steinman, B.A. Steinman, and R.P. Garzia. Foundations of Binocular Vision: A Clinical Perspective

M. Scheiman and B. Wick. Clinical management of binocular vision

R.J. Leigh and D. S. Zee. The Neurology of Eye Movements

The Leigh and Zee book is the classical clinical reference, now at its 5th edition, and I suggest its purchase for your professional collection.

R.W. Baloh and V. Honrubia. Clinical Neurophysiology of the Vestibular System

Class schedule and topics

(note: the list of topics are only indicative - test dates can be changed upon request from the class if overlapping with other tests and can be taken outside normal class hours, if so requested)

Liu Lectures (8 hours + 2 hours test):

NOTE: NO CLASS Mon 06/05/2017 8-10 AM

1-2 Mon 06/05/2017 10-12 AM

- *Terms and basic concepts*
- *Introduction to binocular single vision (the benefits and penalties of having two eyes)*
- *Binocular eye movements (how the two eyes move together, Hering's law of equal innervation)*
- *Monocular visual directions (retinotopic map, local signs)*
- *Oculocentric visual directions (where things are relative to visual axis)*
- *Egocentric visual directions (where things are relative to the body)*

- *Binocular visual directions (how visual directions in the two eyes are combined into one percept; Utrocular and ambiocular vision)*

3-4 Tue 06/06/2017 10-12 AM

- *Perceived visual directions (Hering's law of visual directions)*
- *Absolute and relative binocular disparity*
- *Diplopia (double vision is everywhere, how to achieve binocular single vision)*
- *Binocular fusion - two merged into one (motor fusion & heterophoria/sensory fusion & Panum's fusional area)*
- *Binocular suppression - winner takes all*
- *Binocular rivalry - one image at the time*

(note Wed 06/07/2017 10-12 AM is OPT 132)

LABS ON LIU PART: Thu 06/08/2017 (see lab section of syllabus)

5-6 Mon 06/12/2017 8-10 AM

- *Binocular space perception*
- *Theoretical horopters (Vieth-Müller circle)*
- *Empirical horopters (various ways to measure horopters)*
- *Quantitative descriptions of horopters*
- *Distorted binocular visual space (uniform magnification and aniseikonia)*

7-8 Tue 06/13/2017 10-12 AM

- *Depth perception on 2D canvas - seeing depth with one eye (foreshortening, shading, occlusion, perspective, size constancy)*
- *Depth perception in 3D space (stereoscopic depth perception, disparity and perceived depth, creating stereograms, viewing stereograms, stereoacuity)*

Busettoni Lectures and Tests (28 hours + 2 hours final):

1-2 Wed 06/14/2017 10-12 AM

- *Oculomotor muscles and their innervation*

- *Directions of action of the oculomotor muscles (part 1)*

NO LABS Thu 06/15/2017

3-4 Mon 06/19/2017 8-10 AM

- *Directions of action of the oculomotor muscles (part 2)*
- *Listing's and Donder's laws*
- *Muscle pulleys*
- *Conjugate and disconjugate eye movements*

TEST ON LIU PART: (2 hours) Tue 06/20/2017 10-12 AM.

5-6 Wed 06/21/2017 10-12 AM

Introduction to the brainstem oculomotor circuitry

NO LABS Thu 06/22/2017

7-8 Mon 06/26/2017 8-10 AM

- *Concepts of neural integration and final common pathway*
- *Motor palsies and strabismus*
- *Lesions of the MLF and "One and a Half" syndrome*
- *Blinks*

9/10 Tue 06/27/2017 10-12 AM

- *Head rotation and translation*
- *Rotational and linear vestibular systems*
- *Anatomy*
- *3-neuron arc and velocity storage*

11-12 Wed 06/28/2017 10-12 AM

- *Adaptive properties of VOR*
- *Caloric nystagmus*

NO LABS Thu 06/29/2017

13-14 Wed 07/05/2017 10-12 AM

- **TEST # 1 (hours 1 to 8) - 1 hour**
- Disorders of the vestibular system
- Tullio phenomenon

15 Wed 07/05/2017 4-5 PM **MAKE UP HOUR FOR JULY 4th**

- Introductions to the visual tracking systems

LABS Busetтини: Thu 07/06/2017 (see lab section of syllabus)

16-17 Tue 07/11/2017 10-12 AM

- Optokinetic systems and 3-D environments
- The optokinetic systems and their relationships with the vestibular systems

18-19 Wed 07/12/2017 10-12 AM

- The smooth pursuit system
- Visual fixation.

20 Wed 07/12/2017 4-5 PM **MAKE UP HOUR FOR JULY 4th**

- Nystagmus and oscillopsia

LABS Busetтини: Thu 07/13/2017 (see lab section of syllabus)

21-22 Tue 07/18/2017 10-12 AM

- **TEST # 2 (hours 9 to 20) - 1 hour**
- The saccadic system: function
- The concept of local feedback
- Saccadic metrics

23-24 Wed 07/19/2017 10-12 AM

- Saccadic subcortical and cortical structures
- Disorders of the saccadic system
- Saccadic intrusions

LABS Busetтини: Thu 07/20/2017 (see lab section of syllabus)

25-26 Tue 07/25/2017 10-12 AM

- Vergence eye movements
- Interactions of vergence with the saccadic system
- Accommodation and pupillary responses. Near Triad

27-28 Wed 07/26/2017 10-12 AM

- Vergence and accommodation cross-talk: the Dual Interaction model
- Effects of prisms and lenses
- Concluding remarks and questions

LABS Busettoni: Thu 07/27/2017 (see lab section of syllabus)

Test # 3 (final), time and date TBA, will cover hours 21-28.

Organization of the laboratory sessions

For Liu laboratory sessions, the class will be divided in the 4 groups (A, B, C and D) as indicated in the schedule, in order to be compatible with the OPT 132 and CLN 131 concurrent classes/labs. There will be 2-hour demos for each of the groups.

For Busetini laboratory sessions the class will be divided into 4 Thursday morning groups (A1 A2 B1 B2) and 4 Thursday afternoon (C1 C2 D1 D2) groups. The Class President will be in charge of organizing the composition of the 8 groups and give the list to Busetini. Note as the groups need to be compatible with the groups used in OPT 132 and CLN131.

Swaps are allowed, as long as all students participate to all required sessions. Each student will sign the list at the beginning of each lab session to record his/her participation. Participation to these sessions is compulsory. At the end of each laboratory session of Dr. Busetini, a take-home questionnaire will be given to the student. These two questionnaires, to be completed by each student independently, need to be returned to Dr. Busetini at the time of the final test for their grading.

A short introduction will be given before each experiment. These are totally painless and safe experiments.

Liu laboratory sessions:

There are four experiments planned for this part of the class:

- Measuring longitudinal horopter
- Measuring geometric and induced effect
- Measuring the forced duction fixation disparity curve
- Binocular vision demonstrations

In each 2-hour lab session, each group will work on one experiment for half hour and then switch experiment. **Liu laboratory sessions will be in room HPB 305.**

Typically, each group will elect a subject for an experiment, who will view the visual stimulus and generate the data. The rest of the group will help to take notes, write down numbers, plot curves, or provide moral support. However, before starting the experiment, everyone should try the experiment first and get an idea what is being measured. There will be lab report forms for the four experiments to complete.

Schedule:

<i>GROUP A : Thu 06/08/2017</i>	<i>8-10 AM</i>
<i>GROUP B : Thu 06/08/2017</i>	<i>10-12 AM</i>
<i>GROUP C: Thu 06/08/2017</i>	<i>1-3 PM</i>
<i>GROUP D: Thu 06/08/2017</i>	<i>3-5 PM</i>

Busetini laboratory sessions:

The first block of 2 hours will be in the VOR Clinic, located in the Pediatric Clinic on the ground floor of HPB, using the NKI vestibular system. The second block of 2 hours will be in Busetini's old primate laboratories on the 4th floor **in Worrell**, fully renovated for human experiments/demonstrations after the monkey laboratories were transferred to the Research Support Building. These are small rooms, and space is very limited. Thus, the 32 hours assigned to these laboratory sessions will be divided into 2 blocks of 16, with the 8 groups of 6-7 students rotating every two hours. This way each student will have a total of 4 hours of laboratory time. The first two hours will be focused on the vestibular and the optokinetic systems, while the second two hours will be on the smooth pursuit, saccadic, and vergence systems.

In these oculomotor/vestibular experiments, a student will volunteer to be the experimental subject, and will view the visual stimuli (or rotate on a motorized chair during the vestibular experiments). Then, in a second run, the students will swap, so that the first student can see what was happening while he/she was the experimental subject, and vice versa.

Schedule:

Thu 07/06/2017 08-10 AM Group # A1 – lab hours 1-2

Thu 07/06/2017 10-12 AM Group # B1 – lab hours 1-2

Thu 07/06/2017 01-03 PM Group # C1 – lab hours 1-2

Thu 07/06/2017 03-05 PM Group # D1 – lab hours 1-2

Thu 07/13/2017 08-10 AM Group # A2 – lab hours 1-2

Thu 07/13/2017 10-12 AM Group # B2 – lab hours 1-2

Thu 07/13/2017 01-03 PM Group # C2 – lab hours 1-2

Thu 07/13/2017 03-05 PM Group # D2 – lab hours 1-2

Thu 07/20/2017 08-10 AM Group # A1 – lab hours 3-4

Thu 07/20/2017 10-12 AM Group # B1 – lab hours 3-4

Thu 07/20/2017 01-03 PM Group # C1 – lab hours 3-4

Thu 07/20/2017 03-05 PM Group # D1 – lab hours 3-4

Thu 07/27/2017 08-10 AM Group # A2 – lab hours 3-4

Thu 07/27/2017 10-12 AM Group # B2 – lab hours 3-4

Thu 07/27/2017 01-03 PM Group # C2 – lab hours 3-4

Thu 07/27/2017 03-05 PM Group # D2 – lab hours 3-4

