Botany 401, Vascular Flora of Wisconsin – course syllabus

Course page in Canvas
https://canvas.wisc.edu/courses/155695
Course webpage
http://courses.botany.wisc.edu/botany_401/

Credits: 4

Level: Intermediate

Breadth: Biological Science

L&S Credit Type: Counts as LAS credit (L&S)

Meeting Time and Location
Lecture - 9:30-10:20 a.m. Tuesday & Thursday, 346 Birge
Lab 301 - 1:30-3:30 p.m. Monday & Wednesday, 243 Birge
Lab 302 - 1:30-3:30 p.m. Tuesday & Thursday, 243 Birge

Instructional Mode
All face-to-face in both lecture and lab formats

How Credit Hours are met by the Course
The student is expected to have two hours of direct faculty instruction via lecture per week, and four hours of direct laboratory instruction per week. Additional study and reading is expected at a minimum of four hours per week. These lecture, laboratory, and study/reading hours will occur during each of the first 12 weeks. In addition, each student will spend a minimum of 30 hours during the final two weeks in inventorying, collecting, identifying, and mounting specimens from the local flora of a forest site.

INSTRUCTORS

Professor Ken Sytsma – Lectures

Office hours - 10:30-11:30 T Th or by appointment
Birge 250
Preferred contact – *mailto:kjsytsma@wisc.edu*

Teaching Assistants - Labs

Valerie Gehn	Lab 301	office Birge 301	office hour 12:30-1:30 M W
Tabitha Faber	Lab 302	office Birge 319	office hour 12:00-1:00 T Th

COURSE DESCRIPTION

Taxonomic survey of the vascular plants of Wisconsin, with emphasis on the angiosperms. Lecture, lab and field work. Lab emphasis on representative families and genera of flowering plants in Wisconsin, use of keys and manuals, plant collection. Recommended for botany majors; lecture and lab.

Requisites

Sophomore standing and Biology/Botany/Zoology 151, Biology/Botany 130, Biology/Zoology 101, Biology/Biocore 301, or Biology/Biocore 381

LEARNING OUTCOMES

1. Become familiar with a local flora: species diversity, biogeographical patterns, rarity, natural history, and ethnobotany
2. Learn skills of identifying organisms, using keys and manuals – for use anywhere in the world
3. Take "ownership" of a forest site and learn the woody and herbaceous plants that exist there

GRADING

2 lecture/lab exams @ 90	180 points
1 final exam in the field	90 points
Forest site plant collection & site report	80 points
1 written species report	30 points
Attendance & participation	20 points
Total possible points	400 points

Class participation (20 points). You will be graded based on attendance in both lecture and lab! The nature of the course and the material covered necessitate keeping up with the topically linked lectures and labs. Talk to the instructor or TA in advance of missing class or need to attend a different section of lab.

1 written report (30 points) on a vascular species in Wisconsin considered Endangered, Threatened, or Special Concern due on **April 14** in lecture. See handout for more information.

2 lecture/lab examinations (180 points total, 90 points each) on **March 2-3** and **April 15-16**. The examinations will be during the laboratory session.

1 field final examination (90 points) during exam week (**May 3-8**). Scheduling to be done later.

Forest site plant collection and report (80 points) due during exam week (**May 3-8**). See later handout on forest plots for more information — but site should be chosen no later than Mar 11-12 before Spring Break.

LABORATORY SESSIONS

Laboratory meets twice a week, either Monday & Wednesday or Tuesday & Thursday. Material will be set up Monday a.m. and taken down Wednesday a.m., and set up Wednesday a.m. and taken down Friday a.m. In case of planned absence, please come to the other scheduled lab sessions, or come in Tuesday a.m. or Thursday a.m.

FIELD SITE AND PLANT COLLECTION

A forest site will be chosen in which you should be able to recognize all species of angiosperms that come into flower before the final exam, all trees and shrubs whether they flower or not, and the ferns, lycopods, and horsetails that are producing spores. The final exam will be held in this forest site. Forest site plant collection and report (80 points) due during exam week (**May 3-8**). See later handout on forest plots for more information — but site should be chosen no later than **Mar 11-12** before Spring Break.

You or your group will make a plant collection of native and naturalized species from the site. The species must be collected, documented in a field journal, pressed, and dried. They are to be handed in un-mounted within newspaper sheets, except for 3 specimens (from your collection or Student Herbarium backlog) that will be mounted. Collections will not be returned.

FIELD TRIPS

Instructors will offer a local field trip as part of the lab late in the semester. An optional half to full day field trip to a mesic hardwood forest and dry prairie in southern Wisconsin will be given on **Saturday, April 25**. We will see plants and communities that will have been discussed during class.

REQUIRED TEXTBOOK & OTHER COURSE MATERIALS

Black, M.R. and E.J. Judziewicz. 2009. *Wildflowers of Wisconsin and the Great Lakes Region A Comprehensive Field Guide*. *2nd edition*. Univ. Wisc. Press. Specific to Wisconsin; nicely illustrated with descriptions, diagnostic features, and biogeographical distributions. ISBN 9780299230 [approximately $25 on Amazon]

Purchase a hand lens, forceps and dissecting kit for use in the lab — all are available at the University Bookstore.

Lecture outlines will be provided at each leccture & 3-hole punched for 3-ring binder
Lecture powerpoint slide pdfs available on the course webpage:
http://botany.wisc.edu/courses/botany_401/
Color pdfs (1 slide per page) should be useful for viewing. Black and white pdfs (4 slides per page) can be printed out if wanted.
Lab exercises will be provided at each lab session & 3-hole punched for 3-ring binder

Optional textbooks (copies are available in the lab; check them out to see if you want to purchase; *will be used extensively in lab)

*Voss, E.G. & Reznicek, A.A. 2012. *Field Manual of Michigan Flora*. University of Michigan Press. Ann Arbor. ISBN 9780472118 [$25 via University of Michigan Press online]

Harris, J. G. and M. W. Harris. 2001. *Plant Identification Terminology. An Illustrated Glossary*. *2nd edition*. Spring Lake Publ. Spring Lake, Utah. ISBN 9780964022157

Cobb, B., E. Farnsworth, and C. Lowe. 2005. *Ferns of Northeastern and Central North America. 2nd edition. [Peterson Field Guides]*. Houghton Mifflin, Boston, MA. – the best up-to-date guide to ferns and their relatives. ISBN 06183949600

Barnes, B.V. and W.H. Wagner, Jr. 2003. *Michigan Trees: A Guide to the Trees of the Great Lakes Region*. University of Michigan Press – one of the best books on trees (and some shrubs) of this area. ISBN 0472089218

Barnes, B.V., C.W. Dick, and M.E. Gunn. 2016. *Michigan Shrubs and Vines: A Guide to the Species of the Great Lakes Region*. University of Michigan Press. Ann Arbor. ISBN 0472117777 [$27 paperback via University of Michigan Press online http://www.press.umich.edu/296735

Petrides, G. A. 1986. *Peterson Field Guides: Trees and Shrubs*. Houghton Mifflin Co. - superb guide to all woody plants (trees, shrubs, vines) in NE and N Central USA and adjacent parts of Canada. ISBN 0395175798

RULES, RIGHTS & RESPONSIBILITIES

- See the Guide's Rules, Rights and Responsibilities

ACADEMIC INTEGRITY

By enrolling in this course, each student assumes the responsibilities of an active participant in UW-Madison's community of scholars in which everyone's academic work and behavior are held to the highest academic integrity standards. Academic misconduct compromises the integrity of the university. Cheating, fabrication, plagiarism, unauthorized collaboration, and helping others commit these acts are examples of academic misconduct, which can result in disciplinary action. This includes but is not limited to failure on the assignment/course, disciplinary probation, or suspension. Substantial or repeated cases of misconduct will be forwarded to the Office of Student Conduct & Community Standards for additional review. For more information, refer to studentconduct.wiscweb.wisc.edu/academic-integrity/.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES

McBurney Disability Resource Center syllabus statement: "The University of Wisconsin-Madison supports the right of all enrolled students to a full and equal educational opportunity. The Americans with Disabilities Act (ADA), Wisconsin State Statute (36.12), and UW-Madison policy (Faculty Document 1071) require that students with disabilities be reasonably accommodated in instruction and campus life. Reasonable accommodations for students with disabilities is a shared faculty and student responsibility. Students are expected to inform faculty [me] of their need for instructional accommodations by the end of the third week of the semester, or as soon as possible after a disability has been incurred or recognized. Faculty [I], will work either directly with the student [you] or in coordination with the McBurney Center to identify and provide reasonable instructional accommodations. Disability information, including instructional accommodations as part of a student's educational record, is confidential and protected under FERPA." http://mcburney.wisc.edu/facstaffother/faculty/syllabus.php

DIVERSITY & INCLUSION

Institutional statement on diversity: "Diversity is a source of strength, creativity, and innovation for UW-Madison. We value the contributions of each person and respect the profound ways their identity, culture, background, experience, status, abilities, and opinion enrich the university community. We commit ourselves to the pursuit of excellence in teaching, research, outreach, and diversity as inextricably linked goals.

The University of Wisconsin-Madison fulfills its public mission by creating a welcoming and inclusive community for people from every background – people who as students, faculty, and staff serve Wisconsin and the world." https://diversity.wisc.edu/

BOTANY 401 – VASCULAR FLORA OF WISCONSIN - 2020 LECTURE SCHEDULE

Week	Date	Lecture Topic
1	Tues, Jan 21	Introduction, Wisconsin Flora and Vegetation
	Thur, Jan 23	Nomenclature, Classification, Seed-free Vascular Plants I
2	Tues, Jan 28	Seed-free Vascular Plants II, Gymnosperms
	Thur, Jan 30	Flower and Fruit Morphology in Angiosperms
3	Tues, Feb 4	Water Lilies and Buttercups
	Thur, Feb 6	May Apples and Sycamores
4	Tues, Feb 11	Spring Beauty and Sundews
	Thur, Feb 13	Currants and Raspberries
5	Tues, Feb 18	Elms, Mulberries, and Legumes
	Thur, Feb 20	Violets, Aspens, and Gourds
6	Tues, Feb 25	Wisconsin's Endangered Flora
	Thur, Feb 27	Oaks, Birches, and Evening Primroses [No Lab Feb 26/27: Review Session]
7	Tues, Mar 3	Assembly of Great Lake Forests [Exam 1 in lab, Mar 2/3
	Thur, Mar 5	Mustards, Mallows, and Maples
8	Tues, Mar 10	Blueberries and Gentians
	Thur, Mar 12	Nightshades and Morning Glories [Forest Site Location given to TA]
Spring Break	**[Mar 16 - 20]**	
9	Tues, Mar 24	Mints and Snapdragons
	Thur, Mar 26	Honeysuckles and Carrots
10	Tues, Mar 31	Bellflowers and Asters
	Thur, Apr 2	Arums, Lilies, and Orchids

Week	**Date**	**Lecture Topic**
11	Tues, Apr 7	Spiderworts, Sedges, and Grasses
	Thur, Apr 9	Wisconsin's Invasive New Flora
12	Tues, Apr 14	DNA Barcoding of our Flora Report due: Endangered Species [No Lab Apr 13/14: Review Session]
	Thur, Apr 16	NO LECTURE Exam 2 in lab, Apr 15/16
13	Tues, Apr 21	NO LECTURE Local field trip in lab, Apr 20/21
	Thur, Apr 23	**Field Work – no lecture/lab**
	Sat, Apr 25	**Saturday field trip - optional**
14	Tues, Apr 28	**Field Work – no lecture/lab**
	Thur, Apr 30	**Field Work – no lecture/lab**

May 3 - 8 Final Exams in the Field (to be scheduled later)

BOTANY 401 – VASCULAR FLORA OF WISCONSIN - 2020 LAB SCHEDULE

Week	Date	Lab Topic
1	MT, Jan 20/21	NO LAB
	WR, Jan 22/23	1. Vegetative Characters of Vascular Plants; Keying
2	MT, Jan 27/28	2. Seed-free Vascular Plants
	WR, Jan 29/30	3. Gymnosperms
3	MT, Feb 3/4	4. Flower and Fruit Morphology in Angiosperms
	WR, Feb 5/6	5. Water Lilies and Buttercups
4	MT, Feb 10/11	6. May Apples and Sycamores
	WR, Feb 12/13	7. Spring Beauty and Sundews
5	MT, Feb 17/18	8. Currants and Raspberries
	WR, Feb 19/20	9. Elms, Mulberries, and Legumes
6	MT, Feb 24/25	10. Violets, Aspens, and Gourds
	WR, Feb 26/27	Open Review Session in Lab
7	MT, Mar 2/3	Exam 1 in Lab (covering labs 1-10)
	WR, Mar 4/5	11. Oaks, Birches, and Evening Primroses
8	MT, Mar 9/10	12. Mustards, Mallows, and Maples
	WR, Mar 11/12	13. Blueberries and Dogwoods [Forest Site Location given to TA]
Spring Break	**[Mar 16 - 20]**	
9	MT, Mar 23/24	14. Gentians, Milkweeds, and Nightshades
	WR, Mar 25/26	15. Mints and Snapdragons
10	MT, Mar 30/31	16. Carrots and Honeysuckles
	WR, Apr 1/2	17. Bellflowers, Asters, and Goldenrods

Week	Date	Lab Topic
11	MT, Apr 6/7	18. Arums, Lilies, and Orchids
	WR, Apr 8/9	19. Spiderworts, Sedges, and Grasses
12	MT, Apr 13/14	Open Review Session in Lab
	WR, Apr 15/16	Exam 2 in Lab (covering labs 11-19)
13	MT, Apr 20/21	Local field trip in lab
	WR, Apr 22/23	**Field Work – no lecture/lab**
	Sat, Apr 25	**Saturday field trip - optional**
14		
	MT, Apr 27/28	**Field Work – no lecture/lab**
	WR, Apr 29/30	**Field Work – no lecture/lab**

May 3 - 8 Final Exams in the Field (to be scheduled later)

VASCULAR FLORA OF WISCONSIN
Botany 401 — Spring 2020

FOREST STUDY SITE AND PLANT COLLECTION

Choose a forest site, as pristine as possible, for your study. To avoid problems, try to locate forest site up to 20 acres for which you can get permission (friend, relative, etc.) to enter and collect a representative plant for each (non-rare) species that have adequate population sizes. Dane County or surrounding counties would be preferred (see the instructor if your site is further away). Working in groups of up to about four is helpful for both finding a site (if you are not from around this area) and car-pooling. You will be required to recognize on site certain plant species that grow in your approximately 20-acre study site. This means that you should be able to provide the scientific name, the family name, and a common name for the plants. Species that you should know include all angiosperms that come into flower before the final exam, all trees and shrubs whether they flower or not, and the ferns, lycopods, and horsetails that are producing spores. You can work singly or in small groups – then hand in one plant collection, but you will be asked to document the effort you put into the collection. **The deadline for picking a site (and letting your lab instructor know) is March 11 or 12 – sooner the better as some trees and herbs may already be flowering.**

This collection of dried, pressed, identified, and fully labeled plant specimens is due at the end of the semester and is required to pass the course. Your lab instructor will grade the collection on the basis of (1) completeness of sampling for species in your site, (2) correctness of identification, (3) proper preparation of material (presence of flowers, fruits, or other reproductive parts; representative leaves, stems, and roots if possible; pressing; and drying); (4) adequate labeling; and (5) mounting of 1 or more specimens (check with TA on what specimens and how many should be mounted; previously collected specimens but unmounted by former students may be substituted for mounting as necessary).

GUIDE TO PLANT COLLECTING

Do not collect in city, county, or state parks and other designated natural areas. Do not collect in the University of Wisconsin Arboretum. Collecting in these places require special permits, without which fines can be issued. Practice plant conservation in your collecting! Do not dig up entire plants, especially if you are unsure of whether the species is rare, endangered, or threatened. Become acquainted with the DNR publication (available in lab) that lists these plant species. Be careful of plants in certain communities under current stewardship or study (most prairies, including roadside remnants).

Collecting the Plants

1. Plants should be collected in flower or fruit (or other reproductive parts for non-flowering plants). Specimens without these reproductive organs are termed "sterile", and are not usually worth collecting.
2. For small herbs, the entire plant should be collected, including the underground parts. For large herbs, a portion of the underground parts, a part of the stem with attached leaves, plus the inflorescence can make up the sample.
3. For woody plants, branches or twigs bearing leaves and flowers (or fruits or cones) are sampled. Leaves should be padded with extra paper so that the large twigs do not cause the leaves to curl while drying due to air-pockets in the press.

4. Collections should be plentiful enough to nearly fill a folded newspaper sheet (except for small plants that are rare at the place where they were collected; in such cases this should be explained on your label). The leaves and other plant organs should be spread out, before drying, to form a single layer as much as possible.

Constructing the Plant Press

1. The plant press is constructed out of 2 sheets of plywood (12 X 18 inches) as backing, layers of corrugated cardboard (corrugations run cross-wise not lengthwise), and one or two layers of blotters between cardboard. The press is kept tightly closed by two straps or ropes.
2. The plants are pressed within folded newspapers that are individually placed between two blotters or between a blotter and cardboard if only one layer of blotters is used. The newspaper must be small enough to fit within the plywood backing and cardboard layers. Ideally, use a single bi-folded section of the *Daily Cardinal* as it is perfectly sized for the plant press. Pressing plants within these dimensions will insure that the dried plants can be later mounted on the standard herbarium sheets.
3. Presses will be supplied to each student and must be returned to the lab instructor when the collection is handed in.

Pressing Procedures

1. Plants can be collected in the field, trimmed to the appropriate size, immediately pressed in newspaper, placed between the two rigid ends of a plant press, and securely tightened. This "field press" can simply consist of the end boards and precut newspaper sheet. Later the sheets can be placed within blotters and properly dried. Alternatively, the plants can be placed in bags and pressed later. Some plants will quickly drop their petals or wilt so care must be taken that these plants are pressed soon.
2. Roots should be cleaned and free of excess dirt before they are put into the press.
3. Unwanted parts, dead leaves, extra roots or leaves, etc., should be trimmed off before pressing.
4. Plant parts should be arranged so there is as little overlap as possible; stems should be bent sharply and neatly to fit in the paper, not curved or twisted.
5. Plants should not be layered or massed together within the newspaper. If the plant is too large to place in a single fold of newspaper, the plant may be divided into 2 or more sections, each pressed separately and indicated with the collection number and the phrase "1 of 2" or "2 of 2", etc.
6. A **field notebook** should be kept, in which all collections are numbered and all locality data and other notes are written down. Your name and the collection number for each plant should be written, as well, on the front edge of the newspaper sheet in which it is pressed.

Drying Procedures

It is important that the specimens be thoroughly dried by placing the plant press over a heat source: heater vent, fan-driven space heater, radiator, light bulbs, etc. Driers are provided in the lab. Succulent or wet specimens should have the blotters changed as needed to prevent molding. Press straps should be tightened from time to time during the drying process, to keep specimens from wrinkling.

Labels

Notes should be taken in a field notebook at the time the collection is made (not done from memory, days later at home). Each plant specimen (that is, a particular species collected at a given time and place) is given a separate number in the book. This field information is later

transferred to labels that are handed in with the specimens. **Labels must be produced using the available template labels on the lab computers and printed off.**

Locality: Designate this by county and site, accurately enough so that someone else could find the exact place later. This can be expressed by mileage along a highway, distance from a town or from some geographical feature like a hill or lake. **Lat/Long using GPS or Google Earth are mandatory**. Township, range, and section are optional (townships maps for Wisconsin are available in lab).

Habitat: Designate this is general terms, describing the nature of the site where the plant grew. Examples are: roadside banks, open pasture, boggy meadow, shrubby thicket, shaded woods, rock slide, river bank, cliff, sand dune, etc. Important factors in plant distribution are the amount of light at the site, available moisture, nature of the soil, density of other plant growth, steepness of slope, etc.

Species name: The correct name (**according to University of Michigan Herbarium website**) should include the genus, specific epithet, and authority. The family name should be included on the top. Thus, identification of the species can use Gleason & Cronquist, Spring Flora, Michigan Flora, Peterson Guides, etc., but final name of the species must be checked with the Michigan flora online (it will list all other names or synonyms along with the accepted name).

Other necessary data: Designate the form of the plant (herb, shrub, tree, height, etc.) if this cannot be determined from the specimen. Give the original flower color. Optional information includes the names of other species growing with the one collected, the soil type, the plant community, abundance of the species. The date of the collection, your name, and collection number are mandatory.

Example of a typical label:

ONAGRACEAE
Oenothera clelandii Wagner

WISCONSIN, Iowa Co. Dry prairie along RR track, N
of Helena, 3/4 mi. N on Hwy C from Hwy 14.
43°10'23.99"N 90° 1'17.05"W
T8N, R4E, N 1/4 Sec 16

Scattered individuals, to 1 m high, corolla yellow.
Growing with *Froelichia floridana, Desmodium* sp.

21 Sept 1985 Sytsma 5013

Collection report
A report must accompany your plant collection. This should include a description of the site (geographical location, vegetation type, disturbance) and a list of species (with family and common name) in the collection. Other species noted but not collected (not in flower, large trees) should be included in the description.

Handing in the plant collection (during exam week)
Each specimen is kept in its original pressing paper (or put into a clean new paper), the finished label is inserted loose along with the specimen and the collection ordered alphabetically by family. You must mount at least 3 specimens (from your collection or from a set made available by your instructor) – more information will be provided by your lab instructor. On the outside of the bundle, under the string, place your report. Never put tape or glue on your specimens or newspapers. Also, you must return your press.

Desirable tools and equipment for collecting plants
Hand-lens or pocket magnifier; about 10X
Small pocket knife and/or pruning shears
Trowel or hand-pick (for digging up underground parts)
Large plastic freezer or garbage bags
Field notebook and pencils
Plant press, including newspapers and corrugated cardboard
Field manuals for plant identification

Plant Collection Checklist

____ Collection Report: including a description of the site (geographical location, vegetation type, disturbance), and other species noted but not collected (not in flower, large trees).

____ Cover sheet: a list of all plants in collection, including families and collection numbers.

____ Folder containing all specimens

____ Mounted specimens: three plants must be mounted per student. So if your group has four people, there should be 12 mounted specimens on top inside the folder **.

____ Clearly numbered newspapers containing the remaining, unmounted specimens. Inside each newspaper should be one loose specimen and its accompanying label.

Notes about labels: each and every specimen, mounted or not, MUST have a completely filled-out label. For mounted specimens, these will be glued to the lower right-hand corner of the herbarium sheet. For unmounted specimens, the labels should be placed loose inside each folded newspaper.

** When filling out labels, the names of all members of your group should be included where it asks for collector name. ON THE MOUNTED SPECIMENS ONLY: the individual responsible for that particular mounted plant should have their name first. You will be graded individually on the quality of your mounted specimens, and we will only know which specimens are yours if your name is first on the label. Name order doesn't matter for the unmounted specimens.

Conservation of Wisconsin's Rare Plants
Vascular Flora of Wisconsin

Description: You will write a short report on one selected vascular plant (species or subspecies) that is considered Endangered, Threatened, or Special Concern in Wisconsin. The complete list can be found on the WI DNR website:
http://dnr.wi.gov/topic/endangeredresources/etlist.html
A sign up sheet for each plant species will be available in the Lab.

Objectives: 1) Become familiar with the issues of conservation of rare plant species in Wisconsin. 2) Gain expertise on one rare plant species in the Wisconsin flora. 3) Integrate concepts from a diverse set of areas: systematics, biogeography, conservation, and ecology. 4) Improve written communication and presentation of scientific research and ideas.

You will be required to research and report on the following topics, and any others that you feel are necessary:

- Basic biology (e.g., growth form, flowering times, pollination biology, other life history features) and ecology (e.g., habitat, soil type, moisture regime, mycorrhizal associations) of the plant *(photo images may be attached to report – please cite source of images)*
- Distribution within Wisconsin and elsewhere in North America or the world *(maps may be attached to report – please cite sources of maps)*
- Taxonomic issues (if any) with the species or subspecies.
- Global and state ranks? What do these ranks mean? Articulate the differences between the terms: *endangered*, *threatened*, and of *special concern*.
- Reason(s) plant is rare in Wisconsin. Is it rare in other states/provinces?
- What is being done to protect populations of this species in Wisconsin? In other states?
- What additional measures, in your opinion, should be implemented to protect this species? Why? Be specific.
- Other topics as applicable for your plant species.

Specifics:

This report should be minimally 3 pages in length (double-spaced, 12 pt Times New Roman font, 1" margins). References should be included and cited in the text. The list of references, any photo images, or maps is not included in the 3-page minimum requirement. Your grade will reflect the completeness of your report, depth of thought in addressing the above questions, thoroughness of literature research, and the overall quality of writing and presentation of your report.

Report should be printed out and handed in by **Tuesday, April 14** in lecture; please also email the Word formatted file to your lab instructor (not pdf).

The report is worth 30 pts (out of total 400 pts for course).