UNIVERSITY OF HAWAI'I AT MĀNOA
UHM-1 FORM (ADD A COURSE)

See Guidelines for instructions and deadlines. For undergraduate courses, submit an original and 4 copies; graduate courses, submit an original and 6 copies. If cross-listed, include extra copies for cross-listed department(s) & college(s). List one course per form. Attach additional sheets as needed.

<table>
<thead>
<tr>
<th>1. Course Subject</th>
<th>2. Course Number</th>
<th>3. Effective Term (semester &amp; year)</th>
<th>4. Frequency (check all that apply)</th>
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<tr>
<td>PEPS</td>
<td>400</td>
<td>SPRING/2013</td>
<td>☐ Fall semester ☐ Spring semester</td>
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<td>☐ Alternate years ☐ Summer semester</td>
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5. Offering Status (check one)
- ☐ Regular
- ☐ Experimental
- ☐ Single-term

6a. Full Course Title (Alpha courses: attach separate sheet & specify title for each alpha)
PLANT PEST DIAGNOSIS

6b. BANNER Course Title (30 characters max, including spaces/punctuation. Alpha courses: attach separate sheet & specify title for each alpha)
PLANT PEST DIAGNOSIS

7. Grade Option (check all that apply)
- ☐ Letter Grade
- ☐ Credit/No Credit (500, 700, 700F, 800, 800C only)
- ☐ Audit
- ☐ Honors (Medicine only)

8. Gen Ed Core or Hawaiian/Second Language Requirement Designation (check one)
- ☐ Do not consider for Core or Hawaiian/Second Language designation.
- ☐ Request approval of _______ Diversification (DA, DH, DL, DB, DP, DY, DS), Foundations (FW, FS, FG), or Hawaiian/Second Language (HSL) designation.
  (For Foundations, also submit a proposal to General Education Office.)

9. Contact Hours (meeting hours per week – if variable, specify range)

10. # of credits (if variable, give range)

11. Repeat Limit

12. Credit Limit

9. Contact Hours (meeting hours per week – if variable, specify range)

13. Schedule Type (check all that apply)
- ☐ Lecture (LEC)
- ☐ Laboratory (LAB)
- ☐ Discussion (DIS)
- ☐ Seminar (SEM)
- ☐ Lecture/Discussion combined (LED)
- ☐ Lecture/Laboratory combined (LEL)
- ☐ Thesis/Dissertation (THE)
- ☐ Hybrid Technology Intensive (HTI)
- ☐ Directed Reading or Research (DRR)
- ☐ Field Experience/Internship/Practicum (PRA)

14. Co-requisite Course(s)
NA

15a. Major Restriction (as it should appear in Catalog)
NA

15b. Banner codes of acceptable majors
NA

16. Class Standing Requirement

17a. Prerequisite Course(s) *(Use "and", "ors","and","punctuation to indicate relationships between prerequisites. Or "consent" is implied for ALL prerequisites. Consent requirements can be implemented through your class schedules each semester.)*
NA

17b. Minimum required grade for prerequisites
NA

17c. Blanket requirements listed in Catalog (if none, write "none")
NONE

18. Catalog Description (Limit 35 words; 45 words for alpha courses)

19. Justification Attach separate sheets and indicate the rationale for the request, expected course enrollment, and a course syllabus specifying student learning objectives for the course.

20. Cross-listed or Honors Course(s)

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<tr>
<th>Course Subject &amp; Number</th>
<th>Chair/Director</th>
<th>Signature</th>
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<td>PEPS</td>
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21. Approved By

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<th>1st College or School</th>
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General Education (Undergraduate courses numbered 100-499)

Director

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Graduate Division (600 level and above)

Dean

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Mānoa Chancellor's Office

Vice Chancellor for Academic Affairs

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Rev. 1/2012
Course justification

PEPS 400 Syllabus (Fall 2013)
“Plant Pest Diagnosis”
Lecture/Lab: T-Th 12:00-1:15
Credits (3)

Instructor: Dr. Scot C. Nelson
Office: 402 Gilmore Hall, tel: 956-2000, email: snelson@hawaii.edu
Office hours: By appointment

(From “Guidelines for Course Justifications”)

1. What is the course modification?

Not applicable.

2. Why is the course being requested?

Currently, education and training on the accurate diagnosis of pests and abiotic plant health problems using integrated, holistic thought processes does not exist for undergraduate students within PEPS. Therefore, this new course is requested to fill this important gap in the PEPS curriculum.

The course provides students at the University of Hawaii at Manoa with an opportunity to benefit from faculty expertise, publications, photographs and diagnostic data obtained from years of work experience in Hawaii and the Pacific.

In addition, the training received in the proposed course will supplement the training offered in existing courses for insect pest management (PEPS 421, Foundations of Pest Management) and plant pathology (PEPS 405, Plant Pathogens and Diseases). The PEPS students who take all courses will receive a well-rounded and complete education on plant pests and health problems in Hawaii and the tropics that will prepare them sufficiently for employment as plant health specialists or advisors.

Students will gain extensive first hand experience and skills necessary for their future employment in plant health industries (for example, as plant health crop consultants) in the tropics. If the course proposal is not approved, the students will not be able to efficiently acquire sufficient knowledge and skills needed to serve as plant health crop consultants, diagnosticians, land managers and/or Ag Inspectors in tropical agriculture or enter the plant health industry as fully capable employees.

3. How will the course content be organized?

Please refer to the attached syllabus.
Please refer to the attached learning outcomes presented in syllabus.
4. What other courses at UHM closely parallel the proposed course and in what way will the latter make a distinct contribution?

No other courses at UHM closely parallel the proposed course. No other courses provide in-depth training in the integrated diagnosis of the important plant pest and health problems in Hawaii, the Pacific and the tropics.

5. Where and how does the proposed course fit into the current and future curriculum?

The course serves as a keystone in the training and education of PEPS undergraduates in the practical and applied aspects of plant health management. The course will provide information and skills regarding numerous significant real-life plant health problems experienced in Hawaii and tropical agriculture. The course will integrate with the knowledge and skills gained by students in PEPS 350, 363, 421 and 481, enabling them to diagnose and communicate about plant health problems confidently and efficiently.

6. Why is the number of credits and level justified? Explain the prerequisites.

The number of credits (3) for the proposed course is justified by the weekly number of lecture minutes (150 minutes = 3 credit hours). There is no course pre-requisite.

7. How will the course assist students to achieve the critical skills and competencies of CTAHR graduates?

The course will provide explicit training opportunities and assignments for students to develop and demonstrate competencies within each of the following CTAHR critical skills categories:

a. **Written communications.** Students will prepare a written plant health diagnostic report based on their laboratory and library research activities. In these reports, students will use appropriate writing styles and write in a logical, biologically based, grammatically correct manner.

b. **Oral communications.** Students will prepare well-organized, oral plant health diagnostic report/presentations based on their laboratory and library research activities. In these presentations, students will gain skills to speak in a poised and confident manner, utilize visual materials effectively, utilize appropriate speaking styles and listen to and answer questions about the presentations effectively.

c. **Analytical problem solving skills.** Not addressed by this course.

d. **Personal characteristics.** Behavior and appearance during presentations will be stressed. Students will be expected to be appropriately dressed during their presentation. Listeners and presenters will be expected to exhibit respectful behavior to each other.
e. **Human relations skills.** Students will work together effectively as teams to solve assigned problems in plant health diagnosis. Roles will be assigned or assumed by students within teams. In the process, students will demonstrate professional attitudes and specific group leadership skills. Students will demonstrate sensitivity to others, will avoid discriminatory behavior, and will demonstrate their self-confidence and etiquette skills. Students will demonstrate ability to interact effectively with various sorts of agricultural clients (e.g., farmers) who will receive consulting advice and materials from the students.

f. **"Real world experience".** Students will face real-world plant health diagnosis problems and have to develop understanding and effective solutions for the problems. In the process, students will learn to recognize career opportunities in the area of plant health management and consulting.

g. **Leadership skills.** These skills may be developed during group projects.

h. **Computer skills.** Students will use computers and software as research tools, to prepare reports and presentations, to communicate with clients, to record research data and keep records, and to publish an article or website on a plant disease management topic.

i. **Global perspective.** Students will learn how plant health management options vary according to global geography.

8. **How will students be evaluated?** Students will be evaluated by written examinations, by their written and orally presented reports, by their work as team members, by their completion of assignments, and by their oral participation in class.

9. **What are the minimum qualifications for teaching this course? Is a qualified instructor now available?** The instructor should have a Ph.D. in plant pathology or similar field with at least 5 years of experience in applied, tropical plant pathology. An instructor is available (Dr. Scot C. Nelson).

10. **How will the course be financed, assuming no further cutbacks?** The course will be financed by normal departmental operating funds and operating. Donations from industry (testing materials, plant samples, funds) will also be sought to support the course.

11. **Has the course been offered before? Is there a demand for it?** The course has not been offered before. Dr. Janice Uchida, PEPS undergraduate program advisor, indicates that there is a demand for this course.

12. **Is the course cross-listed with another department?** The course is not cross-listed with another department.
PEPS 400 “Plant Pest Diagnosis”
Syllabus (Spring 2013)

Lecture/Lab: [T-Th, 12:00-1:15]
Credits (3)

Instructor: Dr. Scot C. Nelson
Office: 402 Gilmore Hall, tel: 956-2000, email: snelson@hawaii.edu
Office hours: by appointment

Plant Pest Diagnosis explores the science and methods for the diagnosis of important plant health problems caused by biotic and abiotic agents on key crops in different cropping systems in Hawaii, the Pacific and the tropics.

Learning outcomes:

1. Students will learn how to diagnose and recognize the symptoms of significant diseases and plant health problems for important tropical plants and crops.
2. Students will learn how to make written reports targeted for various clients and Internet delivery.
3. Students will learn how cropping systems and cropping practices affect the development of epidemics and the expression of symptoms.
4. Students will learn modern, advanced laboratory techniques used plant disease diagnosis.
5. Students will learn how to collect samples and how to diagnose diseases in field settings.
6. Students will learn the principles of photography how to take effective photographs of plant diseases symptoms.
7. Students will develop skills in the recognition of the key morphological and biochemical attributes of important plant pathogens.
8. Students will learn to work effectively as team members.
9. Students will demonstrate the ability to clearly communicate the results of critical thinking.
10. Students will learn how to apply skills learned to a current, real-world situation in plant health diagnosis.

Evaluation/grading:

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Points</th>
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<tr>
<td>Midterm Exams (2)</td>
<td>200 points</td>
</tr>
<tr>
<td>Assignment (2)</td>
<td>200 points</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100 points</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td><strong>500 points</strong></td>
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Final grade breakdown: A = 450 and above; B = 400-440; C = 350-399; D = 300-349; F < 300. There will be two assignments: Develop a written and oral report for the diagnosis of an assigned plant health problem. Extra credit opportunities will be available (40 points).
Textbook:
- The Plant Disease Clinic and Field Diagnosis of Abiotic Diseases
- Other reading materials will be provided by the instructor

Lecture Schedule:

LECTURE #1
Course introduction:
1. Syllabus
2. Course objectives
3. Grading
4. The art and science of the diagnosis of plant health problems
5. Skills and knowledge required
6. Relationship of problem diagnosis to problem management

LECTURE #2
Introduction to problem diagnosis: how to proceed; the consequences of an incorrect diagnosis.
1. Identify the plant: genus, species, variety
2. Gather information about the environment
3. Injury versus disease
4. Biotic versus abiotic causation
5. Root versus shoot etiology
6. Pathogen versus insect causation
7. Nutritional versus pathogenic
8. Infectious versus non-infectious
9. The need for experience, information, understanding and diagnostic tests
10. Parasitism
11. Types of pathogens
12. Saprophytes and necrotrophs
13. Secondary invaders and opportunists
14. Hyperparasitism

LECTURE #3
Pathogen groups (discussion of morphology, physiology, parasitism and diseases):
1. Viruses
2. Viroids
3. Phytoplasmas
4. Bacteria
5. Algae
6. Stramenopiles
7. Fungi
8. Parasitic seeds plants

LECTURE #4
The nature of plant diseases (with examples):
  1. The disease triangle
  2. Infection processes
  3. Disease cycles

LECTURE #5
Non-pathogenic parasites and diseases of plants:
  1. Insects
  2. Weeds
  3. Abiotic diseases (e.g., nutritional deficiencies or toxicities, pesticide phytotoxicity, fertilizer burn, sulfur dioxide and air pollution, sunburn)
  4. Injury

LECTURE #6
Plant disease diagnosis as an information science:
  1. Information resources (general, books)
  2. Pathogen reference materials (morphology)
  3. Internet resources
  4. How to search for information
  5. The varying reliability of information resources

LECTURE #7
Collecting plant samples for problem diagnosis (root and foliar problems)
  1. How and where to collect materials
  2. How to preserve materials
  3. How to submit materials
  4. Considerations for different types of plants (e.g., woody vs. herbaceous)
  5. Sampling tools

LECTURE #8
Further sampling considerations for field settings:
  1. Spatial considerations: spatial patterns (uniform, random, aggregated)
  2. Temporal considerations: dynamic versus static development of symptoms
  3. Host phenology: age-related symptom expression
  4. Sampling soils, roots, stems, flowers, fruits, etc.
  5. Destructive vs. non-destructive sampling

LECTURE #9
Symptomatology (introduction):
  1. Physiological functions of plants that affected by parasites and the symptoms expressed: e.g., uptake and translocation of water and nutrients, photosynthesis, respiration, transpiration, reproduction
  2. Types of plant symptoms and terminology: the importance of descriptions and precise and accurate vocabulary
  3. Plant tissues and organs affected by pathogens: roots, crowns, stems, twigs, flowers, fruits, bracts, epidermis, vascular bundles, xylem, phloem. The tissues
affected can suggest causal agents.

4. Understanding the effects of disease in one organ on the expression of symptoms
an unrelated organ that is not infected (e.g., roots and shoots)

5. Diagnostic symptoms vs. non-diagnostic symptoms

LECTURE #10
Exam #1

LECTURE #11
Symptomatology (continued):
1. Pest specificity: host range or tissues and organs infected can be highly specific or
   relatively non-specific
2. Dynamism of symptom development: the continually changing appearance of
   plant disease symptoms
3. Diseases for which symptoms are static
4. Localized vs. systemic symptoms
5. Host resistance and susceptibility and the effects on the incidence and severity of
   symptom expression

LECTURE #12
Disease cycles (with examples):
1. Dispersal (liberation, flight, landing)
2. Inoculation: landing on or in an infection court
3. Infection: recognition and penetration of the host and establishment of the
   pathogenic relationship
4. Disease development: ramification within host tissues
5. Symptom development: host response to infection and disease development (by
   pathogen group)
6. Pathogen reproduction
7. Pathogen survival
8. Understanding disease cycles and the relationship to plant disease diagnosis

LECTURE #13
Pathogen life cycles and morphology (with examples, macro- and microscopic):
1. Fungi: e.g., ascomycetes, fungi imperfecti, basidiomycetes, etc.

LECTURE #14
Pathogen life cycles and morphology (with examples, macro- and microscopic):
2. Stramenopiles
3. Bacteria
4. Nematodes: root knot, reniform nematodes, burrowing nematodes, Stem and bulb
   nematodes, lesion nematodes

LECTURE #15
Pathogen life cycles and morphology (with examples, macro- and microscopic):
1. Viruses and viroids
2. Phytoplasmas
3. Parasitic seed plants
4. Algae (Cephaleuros spp.)
5. Sexual dimorphism in pathogens and relationship to diagnosis

LECTURE #16
Signs of disease (with examples, macro- and microscopic):
1. Macroscopic versus microscopic
2. Diagnostic signs (e.g., oospores, rust, Rhizoctonia mycelium, downy mildew, powdery mildew, sporangia, crown galls, etc.)
3. Fungi: spores, mycelium, and spore-bearing structures
4. Bacteria: Gummosis
5. Nematodes: bodies (Meloidogyne, Rotylenchulus); stylets
6. Viruses: inclusion bodies
7. Recognition and importance of sexual dimorphism
8. Insects
9. The limits of morphological analysis
10. Rats and mice: feeding injury (coffee, banana, kava as examples)

LECTURE #17
Diagnostic tests and methods (field):
1. Tools and clothing required (pocket knife, salinity meter, hand lens, plastic bags, notebook, soil sampling tube or shovel and bucket, saw(s), trowel, pruning shears, camera, boring tool for tree stems, GPS device, audio recording device), hand towel, leather gloves, boots, hat, sunscreen
2. Interviewing growers: how to extract necessary information about site history and cultivation practices, important questions to ask
3. Field tests used for various types of problems (by pathogen group, e.g., wobble test); field examination of plant organs and tissues
4. Photography: the importance of photographic records, types of cameras, lenses, focus, lighting, composition, orientation

LECTURE #18
Diagnostic tests and methods (field):
1. Soil sampling: tools and methods
2. Identifying plant health problems associated with planting, irrigation, fertilizers and cultural practices
3. Identifying plant health problems associated with field location, establishment, history, layout and plant variety
4. Nasal recognition of diseases (how certain diseases have characteristic odors): bacterial soft rots, certain Phytophthora diseases, root-knot nematodes, basidiomycete fungi (mushrooms), Chalara paradoxa (pineapple fruits)
5. Tactile data: observing an describing the texture or feel of diseased plants
6. Written descriptions of what is observed using correct, precise language
7. pH testing
8. Salinity testing

LECTURE #19
Diagnostic tests (laboratory, with examples):
1. Microscopy: compound versus dissecting microscopes
2. Culturing various micro-organisms (by pathogen group: media types and preparation, sterile techniques, equipment required, supplies, tools, methods, by pathogen group)
3. Culturing biotrophs (examples: rusts, powdery mildews, nematodes)

LECTURE #20
Exam #2

LECTURE #21
Diagnostic tests (laboratory, with examples):
1. Identifying pathogen genera and species based on organism morphology: in-depth training (examples include nematodes, bacteria, fungi, parasitic seed plants, algae, viruses)
2. Information resources needed for determinations based on morphology, genetics, physiology and biochemistry
3. Inducing a pathogen’s sexual stage: chilling, growth media

LECTURE #22
Diagnostic tests (laboratory, with examples):
1. Insect hatching chambers: construction and use
2. Bacterial streaming: leaf and stem tissues
3. Slide mounts: plant tissues, pathogen signs
4. Scotch tape mounts
5. Tissue plating: direct
6. Single spore cultures, hyphal tip transfers
7. Humidity chambers: construction and use

LECTURE #23
Diagnostic tests (laboratory, with examples):
1. Koch's postulates: proof of pathogenicity
2. Virus inclusion bodies: epidermal peels
3. Electron microscopy: viruses and viroids
4. PCR: Polymerase Chain Reaction; sequencing and comparison with existing data in gene banks
5. Other molecular techniques used in plant disease diagnosis

LECTURE #24
Diagnostic tests (laboratory):
1. ELISA (Enzyme-linked Immunosorbent Assay: description of antibodies and enzyme; ELISA plates and strips; when to use ELISA
2. Seroblots
3. Biochemical tests for identifying and distinguishing bacteria (Enterotubes, testing flowchart for identifying bacterial genera using growth media, LOPAT, others)
4. Gram staining, KOH test for bacteria

LECTURE #25
Diagnostic tests (laboratory, with examples):
1. Local lesion assays
2. Baermann funnels for plant-parasitic nematodes
3. Mist extraction systems for plant-parasitic nematodes
4. Tissue excision for nematodes (root knot, reniform)
5. Floating baits for recovery *Pythium* and *Phytophthora* spp.: carrot disks, pineapple leaves (basal white tissues)

LECTURE #26
Diagnostic tests (laboratory)
1. Tissue staining: roots versus shoots; cotton blue (fungi), acid fuchsin (nematodes)
2. Testing pH
3. Testing electrical conductivity (salinity)
4. Tissue testing (nutrients): understanding and recognizing nutrient deficiency symptoms, how to sample (based on host phenology) and which nutrients to test
5. Tissue testing (for herbicides)
6. Specialized diagnostic testing services

LECTURE #27
Professional testing services (examples), how and when to use them:
1. UH-CTAHR ADSC (University of Hawaii at Manoa Agricultural Diagnostic Service Center)
2. AGDIA ([http://www.agdia.com](http://www.agdia.com))
3. UH-CTAHR Cooperative Extension Service
4. Soil testing labs

How to diagnose diseases that are unknown, unfamiliar or new to a geographic area:
1. Koch's postulates and proof of pathogenicity
2. Publication of new diseases: *Plant Disease*
3. Consulting information resources

LECTURE #28
Plant health problems having multiple causes or complex etiologies (with examples):
1. Disease complexes
2. Vectored plant diseases
3. Synergism
4. Adult plant resistance
5. Cross protection, induced resistance
6. Role of plant nutrition in symptom expression
7. Identifying primary causation
8. Understanding a chain of events
9. Understanding cause and effect
LECTURE #29
Insect-caused or -related problems that resemble pathogenic problems:
   1. Eriophyid mites (lychee), gall mites (hibiscus); leaf miners (sunflower); psyllids (ohia)
   2. Sooty molds and sooty blotches (palms, banana)
Understanding and improving the reliability of a diagnosis
   1. Factors affecting the level of confidence in a diagnosis
   2. Improving the reliability of diagnoses

LECTURE #30
Student presentations

Lecture #31
Student presentations

LECTURE #32
Review for final examination or student presentations
Written reports due

FINAL EXAM (date to be specified)