PROPOSAL TO INITIATE, MODIFY OR DELETE A COURSE

1. TYPE OF ACTION
   - A. Addition: [X] Regular or [ ] Experimental or [ ] Other __________________ (specify)
   - B. Deletion
   - C. Modification: [ ] in credits [ ] in title [ ] in number or alpha [ ] in prerequisites/corequisites [ ] other __________________ (specify)

2. NEW ALPHA, NUMBER AND TITLE
   - BOT 210 Phytobiotechnology

3. CREDITS 4

4. OLD ALPHA, NUMBER AND TITLE

5. CREDITS

6. NEW CATALOG DESCRIPTION (If necessary, continue on another page)
   Introduction to practical aspects of Plant Biotechnology. Topics include micropropagation techniques, such as plant tissue, cell and protoplast cultures; DNA-based technologies, such as DNA extraction, DNA sequencing, PCR; and methods of plant genetic engineering. This course is designed to train students for careers in advanced agriculture technology and industry (3hrs. lect.; 3 hrs. lab.).

7. PREREQUISITES, COREQUISITES, OR RECOMMENDED PREPARATION
   See Exhibit 3

8. STUDENT CONTACT HRS. PER WEEK
   - Lecture
   - Lecture/Lab 3/3
   - Lab

9. PROPOSED DATE OF FIRST OFFERING
   - Summer/Fall 2002

10. THIS COURSE [X] IS PROPOSED FOR THE Liberal Arts PROGRAM
    [X] CAN FULFILL Natural Sciences (Biol. Science) AA and lab.

11. THIS COURSE [X] INCREASES [ ] DECREASES [ ] MAKES NO CHANGE IN NUMBER OF CREDITS REQUIRED FOR THE PROGRAM / CORE

12. EQUIVALENT OR SIMILAR COURSES OFFERED IN THE UH SYSTEM:

<table>
<thead>
<tr>
<th>Campus</th>
<th>Alpha Number, Title</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
</tr>
</tbody>
</table>

13. THIS COURSE IS
   - [ ] ALREADY ARTICULATED [X] APPROPRIATE FOR ARTICULATION with the UH system
   - [ ] NOT YET APPROPRIATE FOR ARTICULATION
   (Provide details of existing or desired articulation (date, college(s), purposes, pre-major or major, etc.)

   See attached Exhibit 1

14. REASON FOR INITIATING, MODIFYING OR DELETING COURSE OR OTHER PERTINENT COMMENT:
   BOT 210 was initially funded, in part, by the Millennium Workforce Development Initiative (MWDI) from April 6 to June 30, 2001 (see attached Exhibit 2). This course prepares students for careers in the rapidly growing field of plant biotechnology. It offers a transfer level (elective for B.Sc. in Plant and Environmental Biotechnology) to the College of Tropical Agriculture and Human Resources, UHM.

REQUESTED BY: ____________________________

APPROVED BY: ____________________________
<table>
<thead>
<tr>
<th>Levels of Review of Course Proposal at WCC</th>
</tr>
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<tbody>
<tr>
<td><strong>Course Alpha Number and Title:</strong> BOT 210 Phytobiotechnology</td>
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<table>
<thead>
<tr>
<th>Signatures</th>
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<tbody>
<tr>
<td><strong>Department Area (more than one instructor in the department)</strong></td>
<td></td>
</tr>
<tr>
<td>Joseph E. Ciotti</td>
<td>8-30-01</td>
</tr>
<tr>
<td>Dolmen &amp; Apollon</td>
<td>8-30-01</td>
</tr>
<tr>
<td>J. E. Claus</td>
<td>9-30-01</td>
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<table>
<thead>
<tr>
<th><strong>Department</strong></th>
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<tr>
<td>Department Chairperson</td>
<td></td>
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</table>

This course was reviewed and approved in a department meeting on 8/30/01.

<table>
<thead>
<tr>
<th><strong>Division</strong></th>
<th>9/20/01</th>
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<tbody>
<tr>
<td>Valerie Cortoni-Mulliken</td>
<td></td>
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</table>

Assistant Dean of Instruction

<table>
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<tr>
<th><strong>Curriculum Committee Review</strong></th>
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<tbody>
<tr>
<td>Approved 6</td>
</tr>
<tr>
<td>Disapproved 0</td>
</tr>
</tbody>
</table>

Reason:

Curriculum Committee Chairperson

(Revised March 2000)
EXHIBIT 3

PREREQUISITES:
Concurrent registration in BOT 101, or AG 152, or MICRO 130 and MICRO 140, or BIOL 171/171L, or consent of the instructor; Eligibility for placement in MATH 25.

RECOMMENDED PREPARATION:
High school biology, and chemistry, and MATH 24.
1. How is this course related to the educational needs and goals of the College/Department/Community as reflected in the EDP?

Provides students with knowledge and technical skills for immediate employment in the biotech industry in Hawaii. Facilitates student transfer to UHM's Bachelor of Science Degree program in a related field. It also meets the EDP's Goal B.1.a. "Develop additional 200-level course in pre-major areas..........

2. Provide details of any additional staff, equipment, facilities, library/media material, faculty preparation and other financial support that would be required to implement this course. (Include an estimate of the actual cost of supplies and equipment.) What has been done to provide for these additional costs for the proposed date of offering? Who will teach the course?

No additional cost required for lab supplies and equipment. They were already purchased through MWDI funding in Summer 2001. A qualified instructor in the Natural Science Department will teach the course. An honorarium, however, will be needed for a guest instructor to teach 2 - 3 lab sessions of DNA sequencing only.

3. Is a similar course taught elsewhere in the UH system? No
   If yes, provide details of how this course differs from existing similar courses.

4. Is this course experimental and/or unique to Windward Community College? No
   If yes, provide rationale and details of its impact on the College curriculum.

5. Is a similar course taught on the upper division level by a 4-year UH college? No
   If yes, explain why this course is appropriate at the lower division or how it differs from its upper division counterpart.

6. Please attach a complete course outline. Your course outline should address all the items listed in the Guidelines for Course Outlines.

7. If this course is numbered 100 or above or appropriate for transfer to a 4-year college, complete and attach WCC Form for Transfer Courses (blue). (See attached criteria for transfer courses.)
TO: Interim Provost Angela Meixell

SUBJECT: Allocation for Millennium Workforce Activities

Windward Community College has been awarded the following in conjunction with Act 178, the education and training initiatives in support of the Millennium Workforce Development Initiative:

General Plant Biotechnology (Ingelia White) $19,500

In setting up the account for the Millennium Workforce Development Project, use appropriation G-01-302-F. Use F.O. Code "034" and whatever attributes you need for your campus. A FMIS-40 Security form must be completed for those who need access to the account. In addition, please provide an expenditure plan for the fourth quarter. Reports will be sent to Wallace Nishihara and copies will be forwarded to you. Please insure that all funds allocated for this project are expended by June 30, 2001.

Please feel free to have people contact Vice Chancellor Michael Rota at 956-7471 (mrota@hawaii.edu) or Wallace Nishihara at 956-3861 if they have any questions.

Joyce S. Tsunoda
Senior Vice President, University of Hawai‘i
and Chancellor, University of Hawai‘i Community Colleges

c: Vice Chancellor Rota
Wallace Nishihara
Ingelia White

April 6, 2001
Date: Tue, 28 Aug 2001 14:52:44 -1000
From: hako@hawaii.edu
To: Ingelia White <ingelia@hawaii.edu>
Cc: saul@hawaii.edu, manshard@hawaii.edu, dchr@hawaii.edu, dulai@hawaii.edu, hapai@hawaii.edu
Subject: Re: BOT 210 (consideration for an articulation)

Sorry for the delay. I forgot about your request for a while. The course is interesting and looks good. We really do not have any course similar to this at Manoa, as far as I know. I am sure that advisors won't mind including your course as an elective. We have slot for a natural science elective as a replacement for the language requirement.

At 11:33 AM 8/3/2001 -1000, you wrote:
> Dear Dr. Ako and Ms. Chun,
>
> I talked to you earlier today regarding a new credit course (BOT 210: Phytobiotechnology), which I developed and was funded, in part, by the Millennium Workforce Development Initiative (April to June 2001). This course is designed to train students for careers in rapidly growing field of plant biotechnology. It will be offered at Windward Community College either in Summer /Fall 2002 (see attached course outline and course schedule).
>
> The past two summers (2000/2001), I had offered Plant Biotechnology training courses at WCC. These training courses (non-credit) were funded by the Millennium Workforce Development Initiative in Summer 2000, and by the Pacific Center for Advanced Technology Training in Summer 2001. There are a total of 45 students in those classes. Some of them expressed interest in pursuing a higher degree in the field of plant biotechnology. I would like to ask your consideration for having BOT 210 to be articulated with your program at the College of Tropical Agriculture and Human Resources at UHM.
>
> The course proposal for BOT 210 will be discussed at the WCC's Curriculum and Academic Affairs Committee meeting early next month.
>
> Thank you very much for your approval and assistance. Greatly appreciate your timely response.
>
P.S. We are developing an Academic Subject Certificate in Bio-Resources and Technology, with specialization in Plant Biotechnology, and Bio-Resource Development & Management, (funding from USDA-CSREES in September, 2001).
>
>Sincerely,
>Ingelia White Ph.D.
>Instructor, botany, agriculture and microbiology
>Director, Kuhi La‘au-Tropical Plant and Orchid Identification Facility
>Dept. of Natural Sciences
>Windward Community College
>45-720 Keahala Road
>Kaneohe, Hawaii 96744
>Fax: 247-5362
>phone: 235-7318
>e-mail: ingelia@hawaii.edu
>
>Attachment Converted: "c:\eudora\attach\course outline (BOT 210).doc"
>
>Attachment Converted: "c:\eudora\attach\course schedule (bot 210).doc"
Ingelinea,

Thanks for the email and letting us know about the course. The attachment did not convert for me, but the course sounds good as you describe. This is the kind of cooperation and overlap that we need.

David

> Dear Dr. Ako and Ms. Chun,
>
> I talked to you earlier today regarding a new credit course (BOT 210: Phytobiotechnology), which I developed and was funded, in part, by the Millennium Workforce Development Initiative (April to June 2001). This course is designed to train students for careers in rapidly growing field of plant biotechnology. It will be offered at Windward Community College either in Summer/Fall 2002 (see attached course outline and course schedule).
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>Sincerely,

Ingelia White Ph.D.
Instructor, botany, agriculture and microbiology
Director, Kuhi La'au-Tropical Plant and Orchid Identification Facility
Dept. of Natural Sciences
Windward Community College
45-720 Keahalani Road
Kaneohe, Hawaii 96744
Fax: 247-5362
Phone: 235-7318
e-mail: ingelia@hawaii.edu

* * * * * * * * * * * * * * * * * * * * * * * * * * *

David A. Christopher, Ph.D.
Associate Professor
Dept. of Molecular Biosciences & Bioengineering
University of Hawaii
1955 East-West Rd.
AgSciences III Rm 218
Honolulu, HI 96822
Ph. 808-956-8550
WINDWARD COMMUNITY COLLEGE

Course Outline

COURSE NAME: Phytobiotechnology

COURSE ALPHA: BOT 210

CREDIT HOURS: 04

CATALOG DESCRIPTION:

Introduction to practical aspects of Plant Biotechnology. Topics include micropropagation techniques, such as plant tissue, cell and protoplast cultures; DNA-based technologies, such as DNA extraction, DNA sequencing, PCR; and methods of plant genetic engineering. This course is designed to train students for careers in advanced agriculture technology and industry (3 hrs. lect.; 3 hrs. lab.).

REQUIREMENTS COURSE SATISFIES:

AT WCC: AA Degree Natural Science requirement for a Biological Science (Natural Science Group 1), and fulfills lab requirement.

AT UHM: Bachelor of Science Degree Program in Plant and Environmental Biotechnology: May be accepted as an elective for the Plant Biotechnology specialization, and an elective for the General Biotechnology specialization.

PREREQUISITES:

Credit or concurrent registration in BOT 101, or AG 152, or MICRO 130 and MICRO 140, or BIOL 171/171L, or consent of the instructor; Eligibility for placement in MATH 25.

RECOMMENDED SPECIAL PREPARATION:

High school biology, high school chemistry, and MATH 24.

ACTIVITIES REQUIRED AT SCHEDULED TIMES OTHER THAN CLASS TIMES:

Students will need to maintain and inspect status of tissue, cell, protoplast cultures and carry out some laboratory procedures on their own at times other than scheduled laboratory periods.
COURSE GOALS:

Upon completion of this course, students should have basic understanding and technical competency in general tissue culture and recombinant DNA technology.

COURSE OBJECTIVES:

The student will demonstrate knowledge and understanding of theories, principles, and laboratory skills in the following topic areas: *In vitro* culture (media preparation, aseptic transfers, isolation, culture maintenance, and operations of tissue, cell, and protoplast cultures), DNA analysis (DNA extraction, sequencing, Gel Electrophoresis, PCR), and genetic engineering techniques (biolistic approach and conjugative plasmid transfer).

The student will also demonstrate the acquisition of plant biotechnology laboratory skills by establishing and maintaining aseptic cultures throughout the semester.

EVALUATION OF OBJECTIVE ACHIEVEMENT:

The evaluation of the student's achievement of course objectives will be based upon class and laboratory participation, laboratory reports, a field trip report, the ability to maintain aseptic cultures, and examinations as described below.

*Lecture and Laboratory Participation*

The student will actively participate in all lecture and lab activities (100 points). The student is also expected to work safely and efficiently in the laboratory. Thus, the student will be graded on lecture and laboratory attendance, level of participation, and laboratory work habits. Because of the difficulties in setting up laboratory material, students missing a regularly scheduled laboratory activity cannot be given an alternative assignment. Failure to participate in a scheduled laboratory session, will result in a 15 point deduction for each session missed. Students missing more than four three-hour laboratory sessions will not receive credit for the course.

*Laboratory Reports*

The student will complete a total of three written formal laboratory reports (300 points). Each lab report consists of modules assigned for specific lab periods. Lab reports must be completed and turned in on the days of exam I, III, and IV (see schedule of lecture and lab activities).

*Field Trip Report*

Field trip to the Pacific Basin Agricultural Research Center is mandatory. One field trip report (100 points) should be turned in within a week following the trip.
In Vitro Culture Maintenance

Students will maintain their own in vitro cultures (100 points). Assessment will be based upon non-contaminated and healthy cultures throughout the semester. Media transfer should be done accordingly. Students should detect contaminated cultures as early as possible to repeat the operation before the end of the semester.

Examinations

The student will take a total of four unit examinations (400 points) to assess the student's knowledge and skills in plant biotechnology. Exams are non-cumulative.

METHOD OF GRADING:

The assignment of points will be described by the following protocol:

Lecture and laboratory participation .................. 100 points
Laboratory reports (3).................................. 300 points
Field trip report (1)..................................... 100 points
In vitro culture maintenance........................... 100 points
Examinations (4)........................................ 400 points

Total 1000 points

Letter grades will be assigned as follows:

A  -  - 90% or above in total points.
B  -  - 80-89% of total points.
C  -  - 65-79% of total points.
D  -  - 55-64% of total points.
F-  -  - Below 55% of total points; or incomplete official withdrawal from the course.
I  -  -  Incomplete; given at the INSTRUCTOR'S DISCRETION when the student is unable to complete a small part of the course because of circumstances beyond his or her control. It is the STUDENT'S responsibility to make up incomplete work with a minimum level (or better) of achievement. Failure to satisfactorily make up incomplete work within the appropriate time period will result in a grade change for "I" to the contingency grade identified by the instructor (see catalog).
CR-  -  - 65% or above in total points; the student must indicate an intent to take the course as CR/NC in writing by the end of the 10th week of classes (see catalog).
NC-  -  - Below 65% of total points; for BOT 210, this grade only available under the CR/NC option (see above and catalog); the NC grade will not be used as an alternative grade for an "F".
N-  -  - NOT GIVEN BY THIS INSTRUCTOR EXCEPT UNDER EXTREMELY RARE CIRCUMSTANCES (e.g., documented serious illness or emergency that prevents the
student from officially withdrawing from the course); never used as an alternative for an "F" grade.

W- - - Official withdrawal from the course after the third week and prior to the end of the 10th week of classes (see catalog).

Waiver of minimum level of achievement will be given only in unique situations at the instructor's discretion. Students involved in academic dishonesty will receive an "F" grade for the course.

**STUDENT RESPONSIBILITIES:**

Students should carefully review the attached sheet detailing the inherently dangerous activities of this course and sign the appropriate U.H. Assumption of Risk and Release and Medical Consent forms.

Students are expected to attend all lecture and laboratory sessions and participate in all activities and complete all course assignments on time.

Students are expected to be prepared when they arrive for class. Being prepared includes the following: having already read text material (e.g., textbook and handouts) assigned for that day's activities; and bringing required work materials (e.g., writing supplies, textbooks, handouts etc.).

Any changes in the course schedule, such as examination dates, deadlines, etc., will be announced ahead of time in class. It is the student's responsibility to be informed of these changes.

It is the student's responsibility to be informed about deadlines critical to making registration changes (e.g., last day of erase period and last day for making an official withdrawal).

The student should understand BOT 210 is a rigorous class requiring serious attention and study. While the instructor assumes that students enrolled in BOT 210 have little science background, students should expect a level of difficulty comparable to other introductory science classes for pre-professionals. When difficult concepts and detailed information are presented, it is the student's responsibility to take the appropriate steps to learn and understand these concepts and information.

Science courses at W.C.C. generally require two to three hours of independent private study time for each hour in class (depending upon the student's science background). It is the student's responsibility to allocate the appropriate time needed for study in an environment conducive to quality study. The student must budget time efficiently and be realistic about all personal and professional commitments that consume time.

**HOW TO SUCCEED IN THIS CLASS**

Understanding plant biotechnology involves understanding an extended vocabulary and many challenging concepts from many science disciplines, not just knowing facts. You should know that the details to these concepts are important. In addition, you will be introduced to hundreds of new words. In some cases, words that are familiar to you in a context other than biology will be introduced to you. However, you will need to understand and use these terms in a biological context.
You should take careful pre-lab notes and read the corresponding material in the textbook and handouts. As soon as possible (best if you do it the same day), copy over your notes filling in gaps and missing information by referring to the textbook and handouts. You should carefully review these rewritten notes as often as possible. In addition to reviewing these notes before an exam, it would be useful to try to rewrite these notes from memory.

In addition to copying over your notes, your study activities should include drawing your own labeled diagrams or graphs that illustrate important concepts or details. These diagrams need not be works of art, but should clearly illustrate significant information. Before an exam, it would be useful to redraw these labeled diagrams and graphs from memory.

Make flashcards for each new vocabulary word you learn. Read the textbook and handouts corresponding to a particular lecture and lab before and after the class. Review these materials before exams.

**TEXTBOOK AND OTHER ASSIGNED INSTRUCTIONAL MATERIALS**

- Handouts (lab protocols, etc.).
- Videos:
  - Plant Tissue Culture
  - Gene Technology in Agriculture
  - Guide to DNA Biotechnology
  - Molecular Cloning of DNA
  - Cutting and Splicing DNA
  - Manipulating DNA
  - Restriction Enzyme and DNA

**OTHER INFORMATION:**

*Important Dates:*

- Last day to add or drop a class ......................
- Last day of erase period .............................
- Last day for official withdrawal ....................

*Instructor's Office Hours (or by appointment):*
### SCHEDULE OF LECTURE AND LAB ACTIVITIES:

<table>
<thead>
<tr>
<th>Week</th>
<th>Chapter</th>
<th>Lecture</th>
<th>Lab</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>Overview of Biotechnology</td>
<td>Understanding DNA</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Genes, Genetics &amp; Geneticists</td>
<td>Understanding DNA</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Aseptic technique</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>Overview of Molecular Biology</td>
<td>Media preparation</td>
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<tr>
<td>4</td>
<td>29</td>
<td>Science, Technology &amp; Society</td>
<td>Tissue culture (seed, ovule, ovary)</td>
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<tr>
<td>5</td>
<td>30</td>
<td>Risks &amp; Benefit of Biotechnology</td>
<td>Tissue culture (root, stem, leaf, meristem)</td>
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<td>31</td>
<td>Debating the Risks</td>
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<td>6</td>
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<td><strong>EXAM I</strong></td>
<td>Protoplast culture</td>
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<td>32</td>
<td>Bioethical Issues</td>
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<td>8</td>
<td>33</td>
<td>Gene therapy</td>
<td>Field trip to PBARC</td>
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<td>34</td>
<td>Gene Screening</td>
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<td>9</td>
<td>4</td>
<td>Recombinant DNA Technology</td>
<td>DNA spooling</td>
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<td>35</td>
<td>Careers in Biotechnology</td>
<td>Isol. of chloroplast/mitochondria</td>
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<td></td>
<td>App. A</td>
<td>Lab Biosafety</td>
<td>Extr. of plant genomic DNA</td>
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<td><strong>EXAM II</strong></td>
<td>DNA sequencing</td>
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<td>Extraction of Bacterial DNA</td>
<td>Gel Electrophoresis</td>
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<tr>
<td></td>
<td>10</td>
<td>Introduction of Gel Electrophoresis</td>
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<tr>
<td>11</td>
<td>16</td>
<td>Detection of Specific DNA Sequences</td>
<td>Amplification of DNA via PCR</td>
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<tr>
<td></td>
<td>17</td>
<td>DNA Sequencing</td>
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<tr>
<td>12</td>
<td>18</td>
<td>The Polymerase Chain Reaction</td>
<td>(RAPD) PCR &amp; its application</td>
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<td><strong>EXAM III</strong></td>
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<td>13</td>
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<td><strong>App. B Basic Microbiological Methods</strong></td>
<td>Thanksgiving recess</td>
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<td></td>
<td>22</td>
<td>Nature's &amp; Methods of Plant Genetic Engineering</td>
<td></td>
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<tr>
<td>14</td>
<td>19</td>
<td>Transformation of ( E. coli )</td>
<td>Biolistic (PDS/1000/He)</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>Conjugative Transfer of Antibiotic Resistance</td>
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<tr>
<td>15</td>
<td>21</td>
<td>Transduction of An Antibiotic Resistance Gene</td>
<td>Conjugative plasmid</td>
</tr>
<tr>
<td>16</td>
<td></td>
<td>Culture Maintenance &amp; Transfer (continued)</td>
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<tr>
<td></td>
<td></td>
<td><strong>EXAM IV</strong></td>
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</table>
WCC FORM FOR TRANSFER COURSES
(To be completed for articulation with any 4-year UH campus)

Course | BOT 210 | Submitted by | Inge White | Date | August 1, 2001

1. List the counterpart to this course on any 4-year UH campus. Describe the relationship between the course and any related baccalaureate program area.

None

2. Is this course taught or accepted by major accredited colleges or universities? Give one or two examples.

BOT 210 is only offered at WCC. Possible transfer as elective for a B.S. degree program in Plant and Environmental Biotechnology at the College of Tropical Agriculture and Human Resources, UHM.

3. Please attach a complete course outline, if you have not done so already. Your course outline should address all the items listed in the Guidelines for Course Outlines.

See attached Course Outline
COURSE ARTICULATION FORM

ORIGINATING CAMPUS: Windward Community College DATE SUBMITTED: 8/1/01
COURSE ALPHA & NUMBER: BOT 210 SEMESTER CREDITS: 4
COURSE TITLE: Phytobiotechnology

DATE OF OUTLINE: Summer/Fall Year 2002

(*** Representative outline, no multiple syllabi please.)

1. Articulation committee to review this course:

A. Standing Committees
   Written Communication [ ]
   Mathematical & Logical Thinking [ ]
   World Civilizations [ ]
   Languages [ ]
   Arts & Humanities [ ]
   Natural Science [X]
   Social Science [ ]

B. Special Discipline/Program Committee [X]
   Plant and Environmental Biology, CTAHR-UHM

Specify discipline/program

Campus with which this course should be articulated (special articulation only):

UH Manoa [X] UH Hilo [ ] Community Colleges [X] UH West Oahu [ ]

2. In the opinion of the originating campus, this course is equivalent to the following and/or meets
the criteria for the indicated core categories:

<table>
<thead>
<tr>
<th>Receiving Campus</th>
<th>Equivalent Course (Alpha and Number)</th>
<th>Core Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>UH Hilo</td>
<td>None</td>
<td>ILC.Biol</td>
</tr>
<tr>
<td>UH Manoa</td>
<td>None</td>
<td>NS 1</td>
</tr>
<tr>
<td>UH West Oahu</td>
<td>None</td>
<td>NS 1</td>
</tr>
<tr>
<td>Hawaii CC</td>
<td>None</td>
<td>NS 1</td>
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<tr>
<td>Kapolei CC</td>
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<td>NS 1</td>
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<td>Kauai CC</td>
<td>None</td>
<td>NS 1</td>
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<tr>
<td>Leeward CC</td>
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<tr>
<td>Maui CC</td>
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</tr>
<tr>
<td>Windward CC</td>
<td>BOT 210</td>
<td>NS 1</td>
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</tbody>
</table>

3. Notes

Revised 1/29/93
Plant and Environmental Biotechnology (PEB)

Gilmore 210
3050 Maile Way
Honolulu, HI 96822
Tel: (808) 956-6733
Fax: (808) 956-3706
E-mail: chuna@ctahr.hawaii.edu

Degrees Offered: BS in Plant and Environmental Biotechnology

The Academic Program

The interdepartmental Plant and Environmental Biotechnology program, with its five specializations (Environmental and Microbial Biotechnology, Plant Biotechnology, Insect and Pathogen Biotechnology, Aquaculture and Bioreactor Biotechnology, and General Biotechnology), is designed to train undergraduate students for careers in the burgeoning areas of the life sciences involving agriculture, environmental management, industry, and teaching. As an integral part of the program, upper division students gain firsthand laboratory experience in the ongoing research projects of participating faculty.

University and PEB core courses provide students with grounding in mathematics, basic physical and chemical sciences, genetics, and molecular biology. Choice of a specialization directs students to required and elective courses that address their specific interests. The choice of electives is custom-designed by the student in consultation with the faculty mentor.

• The Environmental and Microbial Biotechnology specialization offers classes pertinent to monitoring and reducing chemical and microbial contaminants in the human environment.
• The Plant Biotechnology specialization offers courses in the methods and objectives of plant tissue culture and genetic modification for agricultural or industrial purposes.
• The Insect and Pathogen Biotechnology specialization provides training in technologies that protect plants under human management from attack by insects or diseases.
• The Aquaculture and Bioreactor Biotechnology specialization focuses on the design and operation of artificial environments for efficient production of high value compounds and organisms.
• The General Biotechnology specialization allows students to take the maximum range of elective courses to obtain an overview of biotechnology applications.

Graduates from PEB are prepared to participate immediately in applications of biotechnology in business, regulatory, research, or teaching capacities, or to undertake advanced academic degrees in biotechnology.

Advising

Program leaders (Program Coordinator, Office of Academic and Student Affairs, and Biotechnology Area Advisory Committee) will assign new students on the basis of their interests to faculty mentors in departments that teach courses and conduct research in fields of biotechnology.
Faculty mentors will help students choose elective courses and lab rotations in their areas of specialization after the first year.

Area Advisors:
- Anne Alvarez, General Biotechnology, PEPS
- Harry Ako, Aquaculture and Bioreactor Biotechnology, MBBE
- Dulal Borthakur, Environmental and Microbial Biotechnology, MBBE
- David Christopher, Plant Biotechnology, MBBE
- Richard Manshardt, Plant Biotechnology, TPSS
- Stephen Saul, Insect and Pathogen Biotechnology, PEPS

Undergraduate Study

Bachelor's Degree
1) UH Manoa General Education Core (courses in parentheses are required for PEB majors):
   - Foreign language 14-16 cr
   - History 6 cr
   - Arts & Humanities (including SP 251) 9 cr
   - Social Science (including NREM 220) 9 cr
   - English ENG100 3 cr
   - Math (MATH 215 or MATH 241 and NREM 310) 7 cr
   - Natural Sciences (includes additional prerequisites for PEB majors):
     - Physics PHYS 100/100L or (PHYS 151/151L and 152/152L) 4-8 cr
     - Chemistry (CHEM 161/161L and 162/162L) 8 cr
     - Biology (BIOL 171/171L and 172/172L) 8 cr
   - subtotal 68-74 cr

2) PEB Core (31 cr, required of majors):
   - Organic Chemistry CHEM 272/272L 4 cr
   - Molecular and Cell Biology BIOL 270/270L 4 cr
   - The Biotechnology Age: Issues and Impacts MBBE 201 3 cr
   - Principles of Biochemistry MBBE 402/402L 6 cr
   - Genetics of Insects & Plant Pathogens PEPS 471 (or BIOL 375/375L) 4 cr
   - Molecular Biotechnology MBBE 401 3 cr
   - WI/Internship (Biotechnology Lab Rotation) PEPS 495 4 cr
   - Senior Thesis MBBE 499/PEPS/499/TPSS 499 3 cr*
   - subtotal 31 cr

   *Additional senior thesis credits can count towards electives in specialized option.

3) PEB Specialization - Required and elective courses (30 cr required):
   - Additional requirements for the Environmental and Microbial Biotechnology specialization:
     - Organic Chemistry CHEM 273/273L (4 cr)
     - Environmental Biochemistry MBBE 412 (3 cr)
     - Microbes and Their Environment MICR 485/485L (5 cr)
     - Electives (18 cr)
Additional requirements for the Plant Biotechnology specialization:
- General Botany BIOL 102/102L (4 cr)
- Principles of Plant Physiology BOT/TPSS 470/470L (4 cr)
- Tissue Culture TPSS 440 (3 cr)
- Plant Breeding TPSS 453 (3 cr)
- Plant Pathogens and Diseases PEPS 405 (4 cr)
- Electives (12 cr)

Additional requirements for the Insect and Pathogen Biotechnology specialization:
- General Entomology PEPS 363 (4 cr)
- Plant Pathogens and Diseases PEPS 405 (4 cr)
- Foundations of Pest Management PEPS 421 (4 cr)
- Forensic Entomology PEPS 470 (3 cr)
- Environmental Biochemistry MBBE 412 (3 cr)
- Electives (12 cr)

Additional requirements for the Aquaculture and Bioreactor Biotechnology specialization:
- Vertebrate Zoology ZOO 320/320L (5 cr)
- Biological Pollution Control BE 431 (3 cr)
- Bioreactor Design and Analysis BE 460 (3 cr)
- Electives (19 cr)

Additional requirements for the General Biotechnology specialization:
- Cellular Biology BIOL 406/406L (5 cr)
- Molecular Biology BIOL 407/407L (5 cr)
- Plant Genetics & Molecular Biology MBBE 420 (5 cr)
- Electives (15 cr)