## CHAPTER II

## EDUCATION SYSTEM

Brawijaya University (UB) has an education system named Semester Credit System (SCS) which was determined by Rector Regulation number 22/SK/1976 on May 3rd, 1976. It was decided by considering the Regulation of National Education System number 2 year 1989, Government Regulation number 60 year 1999 declaring about high education and Ministry of National Education number 232/U/2000 stating about handbook of writing for high education curriculum and evaluation of student achievement, number 045/U/2002 declaring about main curriculum of high education and University. UB also considered the guideline of credit system application for high education, guideline of high education process which is based on the basic of semester credit system and guideline for lecturer in the education application system which is based on SCS, so the University published the handbook of the semester credit system process.

University as a high education institution always pays attention on six factors as follow:

1. Each student naturally has differences in terms of talent, purpose and academic skill.
2. The necessary of excellent teacher in society.
3. The rapid development of science and technology
4. Education facilities such as class room, library, and laboratory.
5. The administration staffs influence the process of academic activities.
6. Lecturer is the one who teaches students based on the SKS influences education process.

Thus, good education system is the one which optimally cares and considers those six factors. One of the factors which is viewed as the proper aspect is SKS.

### 2.1 Definition of Semester Credit System (SCS)

#### 2.1.1 General Goal

To increase the quality, the university needs various and flexible education programs. Those programs let the students decide and manage their study easily so they will reach a good achievement.

#### 2.1.1 Specific Goal

a. To give opportunity to students to finish their study in short period.
b. To give chance to students to take courses suitable with their talent, purpose and skill.
c. To apply education system having multiple input and output.
d. To take easy the change of curriculum that is based on the rapid development of science and technology today.
e. To make easy the evaluation of learning system
f. To make possible the transfer of credit among study programs or faculties in one university or other universities.

g. To make possible the transfer of student from inter-university and inter-study program to in certain university.

**2.1.3 Semester Credit System (SCS)**

SCS is a system of education that uses semester credit unit to explain the study load of student, workload of lecturer, study experience and program load.

a. Semester is a unit of study period that runs for 16 to 19 weeks of lecture or other scheduled activities and also the additional activities including 2 to 3 weeks of evaluation program.
b. Semester credit unit is an appraisal for one-semester study with scheduled activity per week that runs one-hour lecture or two-hour laboratory work, four-hour internship and each of them has one-or-two-hour structural activity and one-or-two-hour independent activity.

Characteristics of semester credit system:

- In every semester, there are some courses and every course has load that is explained in semester credit unit based on the curriculum made by a faculty.
- The number of credit for the different course is not necessarily same.
- The number of credit for each course is decided based on the effort to do assignments in lecture, laboratory work, internship, etc.

**2.2 Load and Study Period**

2.2.1 Study load for undergraduate is minimal 144 credits and maximal 160 credits. Those credits are scheduled for 8 semesters and maximal 14 semesters.

**2.3 Main Curriculum and Institutional Curriculum**

High education curriculum that becomes the foundation of study program implementation as follow:

a. Main curriculum
b. Institutional curriculum

**2.3.1 Main curriculum** is the category of study material and subject that must be covered in a study program that is formulated in national curriculum.

a) Main curriculum consists of category of personality development course, courses explaining education goal in terms of science and skill, work skill, personality in working and way of social life, for the minimal requirement that must be achieved by students in finishing a study program.
b) Main curriculum of undergraduates are:
    - Category of MKP (course of personality development)
    - Category of MKK (course of science and skill)
    - Category of MKB (course of work skill)
    - Category of MPB (course of work personality)

- Category of MBB (course of social life)

c) Main curriculum of undergraduate program above about 40%-80% of total SKS.

**2.3.2 Institutional Curriculum** is the number of study material and subject that are part of high education curriculum. Both consist of addition and science category inside main curriculum that is organized by considering condition and necessary as well university characteristics.

Institutional curriculum of undergraduate program consists of either all or part of these aspects below:

a) Category of MKP consists of relevant courses for knowledge, comprehension, and understanding main MPK.
b) Category of MKK consists of relevant courses for comprehensive understanding and increasing knowledge according to competitive and comparative superiority of study program implementation.
c) Category of MKB consists of relevant courses having goal to strengthen understanding and increase knowledge of work expertise according to competitive and comparative superiority of study program implementation.
d) Category of MPB consists of relevant courses for increasing comprehension and knowledge about work personality according to competitive and comparative superiority of study program implementation.
e) Category of MBB consists of relevant courses for increasing comprehension and knowledge about social life both nationally and internationally. It confines students' work in their expertise.

**2.3.3 Course Category**

a) Category of MPK consists of main courses such as education of *Pancasila*, religion, and civilization.
b) Category of MPK for institutional curriculum consists of Indonesian language, English, and etc.
c) Main curriculum for each study program which is determined by ministry based on law number 232/U/2000 remains valid until there is decision of main curriculum from university and other institutions.
d) Institutional curriculum for each study program is decided by each university.

**2.4 Competency**

Competency is a skillful ability with responsibility belongs to somebody as the requirement of public recognition in doing such works.

2.4.1 Competency of Lecture Result for a Study Program

- Main competency
- Supporting competency
- Another competency that is specific and related to main competency.

2.4.2 Elements of Competency are:

- Basic Personality
- Comprehension of knowledge and skill
- Work ability
- Behavior and attitude on work according to skill which is based on the skill and knowledge
- Understanding social life according to expertise chosen for work.

2.4.3 Main Curriculum is Characteristic of Main Competency

Main curriculum of a study program has some characteristics below:

a. Foundation to reach competency of graduates
b. Minimal standard guideline for quality of study program implementation
c. Valid in national and international level
d. Flexible and accommodative on the fast change in the future
e. Joint agreement between university, professional people and graduate employer

2.4.4 Supporting competency and other specific competencies related to the main competency of a study program is determined by institution that has the study program.

**2.5 Evaluation of Student Achievement**

Regular evaluation for some students' activities and comprehension is conducted in exam, assignments, and lecturer's monitoring. The kinds of exam are middle semester and final semester exam, and thesis exam.

**2.6 Study Load in Semester**

The study load is determined based on the average work day and individual ability. Generally, people work about 8-10 hours a day for 5 days. A student is supposed to study for 10-12 hours a day or 50-60 hours a week. Because of that, scs (credit) is determined three-hour work, so study load for each semester is 16-20 credits or about 18 credits. To determine study load in one semester, students have to consider their ability based on achievement in the previous semester that is measured by GPA.

The score of GPA is counted by formulation:

$$GPA = \frac{\sum_{I=1}^{n} KiNA}{\sum n\,Ki}$$

GPA : student achievement in one semester or cumulative achievement index.
K : number of credits for each course
NA : final score for each course
n : number of taken courses

The number of study load on the first semester is equally determined for every student, GPA determines the study load that must be taken by students in the next semester based on the table below:

| GPA | Study load/SCS/credit |
|---|---|
| ≥3,00 | 22-24 |
| 2,50-2,99 | 19-21 |
| 2,00-2,49 | 16-18 |
| 1,50-1,99 | 12-15 |
| <1,50 | <12 |

**2.7 Academic Evaluation**

**2.7.1 General Rules**

a) Academic evaluation of courses is conducted by giving structural assignments, quiz, middle semester exam, final semester exam, and laboratory work evaluation
b) Evaluation of courses in one semester is committed at least twice in one semester
c) Middle and final semester exam are conducted based on the arranged schedule in academic calendar
d) Evaluation is done by giving structural assignments, quiz, middle and final semester exam and laboratory work exam used to decide final score (NA) with certain quality

**2.7.2 Final Score**

a) Evaluation of students' achievement for every course is based on three evaluation options:
   - Using Standard Evaluation System (SES) to decide the graduation limit
   - Using Normal Evaluation System (NES) to compare a score of student with his group's score
   - Using combination system SES and NES to determine graduation limit score, then compare the score that passed the standard with the group
b) The result of final course evaluation is symbolized in quality letter (HM) and quality number (AM) as stated in the following table:

| Quality letter | Quality number | Ability category |
|---|---|---|
| A | 4,0 | Very good |
| B+ | 3,5 | Between very good and good |
| B | 3,0 | Good |
| C+ | 2,5 | Between good and fair |
| C | 2,0 | Fair |
| D+ | 1,5 | Between fair and poor |
| D | 1,0 | Poor |
| E | 0 | Failed |

c) Giving score in every activity can be explained with quality letter (E-A) that will be converted to quality number (0-4)

d) The quality of course evaluation is determined based on the equality of evaluation and course material in one semester.

e) Final score evaluation is conducted by giving quality in every lecture in that semester using formula:

$$NA = \frac{\sum_{i=1}^{n} Bt_i.Nt_i + Bq_i.Nq_i + Bm.Nm + Ba.Na + Bp.Np}{\sum_{i=1}^{n} Bt_i + Bq_i + Bm + Ba + Bp}$$

Bti : quality of assignment score
Bqi : quality of quiz score
Bm : quality of middle semester exam score
Ba : quality of final semester exam score
Bp : quality of laboratory work store
Nti, NqI, Nm, Na, Np : score of every academic activity

f) From the result of formula calculation on point *e*, if it is necessarily converted to quality letter, you can use this guideline:

| Quality number | Quality letter | Score |
|---|---|---|
| ≥3,75 | A | >80-100 |
| 3,25-3,74 | B+ | >75-80 |
| 2,75-3,24 | B | >69-75 |
| 3,25-2,74 | C+ | >60-69 |
| 1,75-2,24 | C | >55-60 |
| 1,25-1,74 | D+ | >50-55 |
| 0,75-1,24 | D | >44-50 |
| <0,75 | E | 0-44 |

### 2.7.3 Revision Exam and Specific Exam

Revision and specific exam are conducted to revise final score of a course that has been taken:

1. Revision exam
   a. Attending all academic activities related to lecture on semester in which it is offered. Revision exam is given to course with highest score C while final score is taken from the best.
2. Specific exam
   a. Specific exam is given to students who have submitted 144-160 credits and finished their final assignment but their GPA is less than 2, 00.
   b. Specific exam is done for courses with maximum score is C+

## 2.8 Academic Punishment

Academic punishment is given to students who disobey some academic rules.

a. Students who attend the lecture less than 80% are prohibited to attend final semester exam for the course at which they do not attend.
b. Students who cancel a course out of the scheduled time, they cannot dismiss it and the course is used to calculate GPA.
c. Students who cheat on exam will get punishment such as the cancelation of all courses that they take on that semester or another punishment that is arranged by faculty.
d. Students who do their mate's assignment and or students whose exam done by another student will get punishment by given cancelation of all their exams in that semester.
e. Students who illegally change the study plan form will be punished by given cancelation of study plan form for all courses in that semester.
f. Students who illegally change their score will be punished by given two-semester study off and it is not considered as terminal.
g. Students who disobey those rules and do crime or deception will be drop out of the faculty.
h. Students who cheat on doing thesis, so all their study plans will be dismissed.
i. Students who are proved doing court crime, will be punished by:
   - Study off if the crime is less than one year
   - Drop out of university if the crime is more than one year

## 2.9 Final Project Exam for Undergraduate Program

To complete undergraduate education program in Brawijaya University, education is conducted by using semester credit system and final project.

### 2.9.1 Final Project Exam for Undergraduate Program

To take the final project exam, a student has to write final project which is a scientific work based on the research finding, review of related literature, internship, field work practice, or other projects offered by faculty.

a) Requirement of final project writing

Students are supposed to write final project if they complete requirements as follow:

1. Listed as student on that academic period
2. Submit a number of certain credit based on faculty rules
3. GPA is minimum 2,00
4. There is no score E
5. Score D/D+ is not more than 10% of credit load total
6. Complete the requirements asked by faculty

b) Procedures and methods of final project writing

Procedures and methods of final project writing are arranged in procedure manual of thesis writing

c) Credit score of final project

Credit score of undergraduate final project in Faculty of Mathematics and Natural Science is 6 credits.

d) Time of final project completion

1. Undergraduate final project must be completed for six months since it has been programmed in study plan form.
2. Time extension, students have to get kind of approval from Dean/Head of Department according to arranged procedures.

e) Final project supervisor

To write a final project, students have to be supervised by 1 or 2 lecturers consisting of main supervisor and supporting supervisor.

1. Requirements for supervisor

   The main supervisor has at least Lector position and master title. The supporting supervisor has at least lector position and master title or assistant with doctor title. To determine other supervisors out of the requirements can be done by Dean with request from Head of Department.
2. Supervisor Selection

   The Dean or Head of Department selects the main supervisor and supporting supervisor based on the suggestion of Head of Department/Head of Study Program. Guest lecturer can be suggested to be the main supervisor or supporting supervisor.
3. Duty and Responsibility for Supervisor

   Duty and Responsibility are:

a. To help the students in searching problems of final project
b. To supervise the students in completing final project
c. To supervise in writing final project

Duty and responsibility for supporting supervisor are to help main supervisor in supervising student's final project.

### 2.9.2 Characteristics and Goal of Final Project for Undergraduate Program

a. The exam for final project is final exam that must be taken by students as the requirements to achieve degree
b. The exam of final project is comprehensive
c. The exam is conducted in oral form and its goal is to evaluate students in understanding science and technology application based on their field
d. The exam of final project is done to give students something good for future

### 2.9.3 Requirements For Taking Final Project

The students are supposed to take final project if they complete following requirements:

a. Listed as a student in certain academic year.
b. Submitting 138 credits based on faculty order
c. Minimal GPA is 2,00
d. There is no score E
e. Total credit with score D and D+ is not more than 10% of total credit
f. Must complete and submit the thesis
g. Submitting the journal draft to department
h. Completing other requirements arranged by faculty

### 2.9.4 Procedures for Taking Exam of Final Project

Procedures for taking exam of final project are determined by faculty considering administration and academic requirements

### 2.9.5 Committee for examiner of final project

a. Committee of examiner is decided by Head of Department based on the main supervisor's suggestion.
b. Committee of examiner consists of three lecturers; a supervisor and one or two examiners
c. Head of examiner is the supervisor or examiner who is appointed by Head of Department
d. Committee of examiner is the lecturers who have completed requirements as follow:
   They have at least academic position of Lektor Kepala (Lector Head) for lecturer with undergraduate degree or Lektor (Lector) for lecturer with master degree, and Asisten Ahli (Expertise Assistant) for lecturer with Doctoral degree. The selection of committee of examiner out of the above requirements will be decided by Dean based on the suggestion from Head of Department.

e. Member of examiner consists of supervisor or non-supervisor.
f. Examiner who is not a supervisor can be selected from lecturer in the department/institution as long as his scientific field is appropriate with the final project.
g. Duties for committee of examiner
    1. Head and secretary of examiner manage the smoothness of exam.
    2. Examiners examine and evaluate the final project.

### 2.9.6 Time of Final Project Exam

The time for exam runs for two hours at maximum.

### 2.9.7 Evaluation

a. Aspects evaluated for final project are:
    1. The quality of final project covering academic quality and writing procedures
    2. Presentation
    3. Understanding the final project which is shown by giving the answer from examiners
b. Final Score
    Head of examiner leads a meeting to give final score which is stated in letter A, B+, B, C+, C, D+, D, or E. Final score of final project covers the exam score and seminar. It is determined by quality made by department and faculty.
c. Students must have score C if they want to pass the exam.
d. Students who have not passed the exam must accept the examiner's decision.

### 2.9.8 Administration For Final Project

a. After taking the exam of final project and passing the exam, students are supposed to revise the final project for 2 weeks and submit it to academic administrator at Faculty of Mathematics and Natural Sciences. It must have been signed by supervisor and Head of Department.
b. The score will be decreased if the students do not submit the revision of final project after 2 weeks.
c. Students have to retake exam of final project if they do not submit it for a month and the fee for the exam must be paid by students.
d. Students have to conduct research again with new title and they can change the main supervisor and second supervisor it they do not submit the revision after two months or more.

### 2.9.9 Undergraduate Yudisium

a. Students will be graduated as a bachelor if:
    - They complete the requirements in chapter 2.7
    - They do not pass the maximum study period (7 years)
    - They upload their photograph and final project in SIAM

- They show the proof of scientific publication

b. Achievement

Achievement of graduates listed in three ranks: good, very good and excellent are written on GPA transcript.

1. GPA 2, 00 - 2, 75 : good (cum laude)
2. GPA 2, 76 - 3, 50 : very good (magna cum laude)
3. GPA 3, 51 – 4, 00 : excellent (summa cum laude)

The achievement for excellent rank is decided by considering study period, for undergraduate is 5 years and program transfer is (n+0, 25) years.

c. Graduate degree

Graduate degree is arranged by Decree of Ministry of Education and Culture number 036/U/1993 February 9th, 1993.

**2.10. Evaluation for Study Achievement**

**2.10.1 Evaluation for Undergraduate Achievement**

Study achievement is described in GPA which is written in the form of number. It is done at least in the end of every semester, first year, second year, third year and fourth year.

a. Evaluation for study achievement in the end of semester

Evaluation is conducted in the end of every semester, it covers the courses that are taken by the students in that semester. This result of evaluation is used to arrange the study load that can be taken in the next semester by looking at following rule:

| GPA that is achieved in the semester | Study load in the semester |
|---|---|
| ≥3, 00 | 22 – 24 credits |
| 2, 50 – 2, 99 | 19 – 21 credits |
| 2, 00 – 2, 49 | 16 – 18 credits |
| 1, 50 – 1, 99 | 12 – 15 credits |
| <1, 50 | <12 credits |

b. Evaluation for study achievement in the first year

Evaluation to determine whether the students can continue to study is conducted in the end of first year since the students have been registered as the student in Brawijaya University. Students can continue to study if they complete some requirements:

1. Submit at least 20 credits including General Courses (MKU)
2. Achieve GPA at least 2, 00 of 48 credits which get the best score

c. Evaluation for study achievement in the second year

Students are still able to continue their study after second year if they complete following requirements:

1. Submit at least 48 credits including General Courses (MKU)

2. Achieve GPA at least 2, 00 of 48 credits which get the best score

d. Evaluation for achievement in the third year

Students are still able to continue their study after the third year if they complete following requirements:

1. Submit at least 72 credits including General Courses (MKU)
2. Achieve GPA at least 2, 00 of 48 credits which get the best score

e. Evaluation for study achievement in the fourth year

Students are still able to continue their study after the fourth year if they complete following requirements:

1. Submit at least 96 credits including General Courses (MKU)
2. Achieve GPA at least 2, 00 of 48 credits which get the best score

f. Evaluation for study achievement in the end of study

The number of credit that must be submitted by a student to complete study program is 144 – 160 credits including thesis/other assignments that are determined by faculty. The number of minimum credit is determined by faculty in that range. Students who have submitted at least that credit means that they have completed the study program if they complete requirements as follow:

1. GPA at least 2, 00
2. Total credits with score D and D+ not more than 10% of credit total
3. There is no score E
4. Passed the final project exam

If GPA has not reached 2, 00, students have to revise the score of course as long as they have not reached the period limit. The revision must be done in the next semester when the course is offered. The best score is the one taken to be evaluated for every course that is revised.

g. Deleting the Course Excess

Students are not allowed to delete the courses that have been programmed and written on the study achievement form.

h. Study period limit

Undergraduate program must be completed not more than 7 years, it is counted when the students have been registered as the students of university. If they do not complete their study for that period, they are regarded as those who cannot continue study. 7-year period does not cover the leave or terminal time, but for those who do not re-register without rector permission remains counted as study period.

### 2.10.2 Evaluation for the Achievement of Program-Transfer Student

Transfer program is a program that is specially given to the graduates of diploma/vocation program who will continue their study to undergraduate level. Their study runs

for 6 semesters (3 years). For those who are accepted as undergraduate student in Faculty of Mathematics and Natural Science have to obey the rules of achievement evaluation as follow.

a. Students are regarded as students who have attended study for 6 semesters when they registered in transfer program
b. Number of credit which is allowed for the first time taken is minimum 72 credits.
c. Evaluation for study achievement for the first one year
   The evaluation for study achievement for the first one year is as same as the evaluation for study achievement for the fourth year of undergraduate program. It covers:
   1. Submit minimum 96 credits
   2. Reach GPA minimum 2, 00 that is counted from 96 credits of courses with the best score.
d. Evaluation for study achievement in the end of undergraduate program
   The number of credit that must be submitted by a student to complete the study is 144-160 credits including thesis/other assignments that are arranged by faculty. The number of minimum credits is determined by faculty in that range. Students who have submitted the minimum credits described above have been regarded to complete their study if they complete the requirements as follow:
   1. GPA minimum is 2, 00
   2. Score D+/D is not more than 10% of the credit total
   3. There is no score E
   4. Passed the undergraduate exam

   If they do not reach GPA 2, 00, they have to revise their score as long as the study period has not ended. The revision is done in the next semester when the course is offered. The best score is the one will be evaluated.

e. Deleting Course Excess
   Students are not allowed to delete the courses excess that have been programmed and written on the study achievement form.
f. Study Period Limit
   Transfer program must be completed for not more than four years, counted when they are registered as the student of undergraduate transfer program. If they do not complete their study in that period, they are regarded as students who cannot continue their study. The four-year study does not cover leave/terminal time but those who do not re-register without rector permission remains counted as study period.
g. Other aspects like equality of a course, additional courses that are not arranged in this guidebook will be arranged by department.

### 2.11 Short Semester Program

#### 2.11.1 Definition

Short semester program is learning program that is conducted in the holiday of even semester.

#### 2.11.2 Goal

To give chance to students to revise their course score that has been taken to increase GPA and to shorten the study period as well as to avoid drop out of study.

#### 2.11.3 Implementation

It covers class room meeting, laboratory work (if any), structural assignment, individual assignment and final exam. The time and implementation are managed by the responsible study program.

#### 2.11.4 Curriculum and Academic Rules

Curriculum and academic rules in the short period still refer to the curriculum and academic rules that are valid and used at that time.

#### 2.11.5 The maximal score for short semester is B+

#### 2.11.6 The limit of maximal SCS that can be taken is 10 SCS

#### 2.11.7 The number of minimal student is 10 students

## CHAPTER III

## EDUCATION ADMINISTRATION

To complete the necessary of semester credit system, the administration of education is continuously improved by giving a service called academic information system (SIAKAD).

### 3.1 Requirements of Administration for Credit System

To serve credit system well, there are several administration requirements that must be completed, here they are:

a. Availability of Guidebook
   It is given before the lecture in the next semester starts, the contents are:
   (1) General rules of education administration
   (2) Courses for study program are appropriate with the level covering position, characteristics, credit, and requirement (if any)
   (3) The number of credit for compulsory and optional courses to complete program study
   (4) Courses offered during the study
b. Availability of Academic Advisor
   Duties for academic advisor
   (1) To lead the students in arranging study plan and to give consideration in selecting courses taken in that semester.
   (2) To give consideration about the number of credit taken by students
   (3) To monitor the improvement of students' study
   (4) To give some important aspects supporting students' study
   (5) To report the level of study improvement to the Dean
c. Student Identity Number

### 3.1 Administration of Credit System

#### 3.1.1 Re-registration of Administration

All students have to re-register regularly and punctually. The registration is directly managed by academic administrator at University/Faculty of Mathematics and Natural Sciences and every academic year is run twice; in the first of odd semester and even semester in that year.

a. Goal
   - To control the academic activities in every semester
   - To know the *student body* and the number of student who actively attend the academic activities in every semester
   - To receive the data of student activity and condition

b. Location and Time of Re-registration
   - Re-registration location is at academic administrator in University/Faculty of Mathematics and Natural Sciences
   - Re-registration time is based on the academic calendar

c. Requirements for Re-registration

Every senior student is supposed to come by himself to complete the re-registration by submitting:

1. Student card of previous semester
2. Tuition receipt received after paying the previous semester if the students continue his study after taking terminal time and tuition for next academic year
3. Completed registration form
4. 2 pieces of recent photograph 3x3 cm
5. Permission letter for continuing study that is received from rector for student who are not registered as student or academic terminal in the previous semester.

d. No Re-registration

a. Students who do not re-register in one semester without having permission from rector are regarded as non active in that semester.
b. Students who re-register late are regarded as non active student
c. Students are able to ask terminal time of academic activity to rector at least one week after the registration is closed. The terminal is maximum 2 years
d. The non active status is considered for the study period including the final evaluation of study
e. There is no extension for re-registration

e. Additional Rules for Student Card and Re-registration

1. For the students who receive the new student card but the content is not suitable with their identity (for example address) can report to University Academic to be replaced. While waiting for the new one, they can use the student card.
2. For the students who do not have student card of previous semester and not more than two-year academic, so they are supposed to show the rector agreement letter. The letter can be obtained by asking a request that proves the reasons why they do not have it. It should also be supported by the Dean of Faculty of Math and Natural Science.
3. For the students who do not have student card but they can re-register by having rector agreement letter, so they will be given a temporary student card for the proof of re-registration.
4. For the students who cannot show their student card of previous semester because they lost it, so they have to ask a rector recommendation letter. It also should be strengthened by the dean letter and police letter.
5. For the students who do not come at the re-registration time because certain reasons, the re-registration can be done by sending a letter, telegram, and telex with sending evidence.

### 3.1.2 The Student Transfer of Inter-department

The students transfer of inter-department can be processed by considering requirements as follow:

1.) Students have continuously attended minimum two semester study and maximum four semester study and they have to submit:
    - For 2 semesters, 24 credits and GPA minimum 2, 75
    - For 4 semesters, 48 credits and GPA minimum 2, 75
2.) They do not continue study because they cannot complete academic requirements
3.) They never disobey the rules of their pervious university
4.) The student's previous university gives approval
5.) Head of Department to whom they asked is willing to accept them
6.) The student transfer of inter-department can only be processed once as long as the student becomes the student of UB.

### 3.1.3 Student Transfer of Inter-Study Program

Student transfer of inter-study program can be processed by considering requirements below:

1.) Students have continuously attended minimum two semester study and maximum four semester study and they have to submit:
    - For 2 semesters, 24 credits and GPA minimum 2, 75
    - For 4 semesters, 48 credits and GPA minimum 2, 75
2.) They do not continue study because they cannot complete academic requirements
3.) They never disobey the rules of their pervious university
4.) The student previous university gives approval
5.) Head of Department to whom they asked is willing to accept them
6.) The student transfer inter-department can only be processed once as long as the student becomes the student of UB.

## 3.2 Academic Re-registration

### 3.2.1 Preparation of Re-registration

Some data that must be prepared for re-registration are:

a. List of academic advisor name and advised student
b. Guideline for completing the form and following cards:
    1. Study plan card (SPC)
    2. Form of Study plan revision
    3. Course cancellation form
    4. Study achievement card

### 3.3.2 The Completion of Study Plan Card

The study plan card can be taken in Faculty academic administrator by showing valid student card of that semester (permanent or temporary with rector approval)

a. To Decide Semester Study Plan
   The decision is arranged by advisor that has been chosen. New students have to take study load that has been arranged in the study plan at odd semester. In this process, the advisor role is minimal. The next study decision is based on the achievement reached by students in the previous semester. The number of study load that can be taken in the next semester is determined by GPA with approval from advisor. Next, students complete the study plan card that has been programmed on the computer in every department according to the schedule. The print-out of the form will be distributed based on the used rule.
b. Study Plan Revision
   The revision is to change a course that has been taken in the same semester. The revision is completed at least in the second week of learning process and must be approved by advisor.
c. Course Cancellation
   The course cancellation means that the students cancel to take the course, so it is not taken as exam subject in that semester. Students are supposed to cancel the course at least in the second week of learning process. This cancellation must be approved by advisor and reported to faculty academic administrator.
d. Study Achievement
   It is a score that is achieved by student for all courses that have been programmed on the study plan form and written on the study achievement form.

**3.3.3 Lecture, Laboratory Work and Examination**

Students are supposed to attend the lecture regularly, laboratory work and other academic activities according to their study plan and applied rules. Schedule of lecture and laboratory work is arranged by themselves.

a. Evaluation for Student Attendance
   The number of student attendance in lecture and laboratory work becomes part of consideration in deciding whether the students are allowed to take middle or final semester exam. A student is allowed to take the exam if the number of attendance is about 80%. If the lecture attendance in the class does not reach 6 times or more before the middle semester exam, so the evaluation for student attendance is not processed and they are allowed to take the exam. It is also applied for final exam, the attendance evaluation is processed if the number of lecture reaches 12 times or more. If it is less than 12 times, so they are allowed to take the exam.
   The result of attendance evaluation is announced before the exam. They have to submit doctor/permission letter for their absence permission to the course lecturer or academic staff at least in the next lecture. If it is late, they are considered as leaving the class.
b. To Plan Course Examination
   1. Final/middle semester Examination

Middle semester exam is a factor to evaluate the course score. It is conducted after the learning process runs 7 times (it depends on the university academic calendar) and the time is scheduled in the 8th and 9th week and arranged by faculty. If the questions of exam need to be copied, they can be sent to the department/faculty to be copied. For final exam, it is collectively conducted for all departments and scheduled by faculty. Because its score is high, the arrangement must be done very well.

2. To Plan exam schedule
   Based on the academic calendar, the schedule of middle and final exam must be planned well and announced to student and lecturer.

c. Examination Process
   1. Principally, exam schedule is made according to learning schedule so there is no clash with student schedule.
   2. Exam question preparation
      The examination is conducted in forms of written, oral or presentation. Lecturers need to prepare the questions and submit to final exam committee. Those questions are two copies, the authentic one is submitted to the committee and the copy is saved by the lecturer. After submitting, the secret is kept by the committee.
   3. Exam question copy
      All questions accepted by the committee need to be copied for students. This copy process must be done at least 3 years before the exam. The committees copy those questions and save them inside a big envelope. Then, they prepare the attendance list, exam sheets, and official report sheet. If those questions will be given in exam, the committees give them to coordinator exam controller.
   4. Exam process
      If the student attendance in the learning process is not enough, their name must be scratched by the committee. Students who cannot attend the exam because of sick or other important reasons must submit the doctor permission letter or explanation letter to the faculty academic administrator. If it is submitted late, it means the students do not take the exam. Coordinator and exam controllers watch over the exam. After the exam is done, coordinator submits the answer sheets, official report sheet, attendance list to department. The attendance list is copied four pieces, one piece and answer sheets are submitted to the lecturer and others are saved by committee. The students getting sick can take the exam in another schedule as long as they have doctor permission letter. The exam is processed after all of the final exams and arranged by the course lecturer after getting approval from the Dean-1.
   5. Submitting answer sheets
      The answer sheets must be submitted to the course lecturer as soon as possible, due to one day after the exam. The official report sheet, attendance list, score sheet and one question sheet are also submitted by the committee.
   6. Evaluating answer sheets

The answer sheets must be evaluated due to one week after the exam. The exam score which is added by other assignment scores are used to determine the GPA/final score and submitted to Vice Dean I. it must be copied 2 pieces.

### 3.3.4 GPA Announcement

The achievement evaluation of study is written on study achievement card. The evaluation must be done by using the instruction on the university guidebook. One of the GPA evaluation that is taken from lecturer and noticed by Vice Dean I/Head of Department/Head of Study Program is announced on the publication board to keep accuracy and rapidity. The change of GPA that has been announced is not allowed except there is a certain excuse from the lecturer and it is noticed by Vice Dean I/head of Department/Head of Study Program.

## 3.4 GPA Administration

### 3.4.1 Study Achievement Card (SAC)

Final score of all courses that is received by student in certain semester will be written on the achievement card. The courses and scores on the card are written based on the study plan card (SPC) as well as the change and cancellation of courses (if any). SAC is copied 4 pieces, one piece is given to advisor for student counseling (to decide courses and credits in the next semester), one piece is given to student, one piece is delivered to student's parent, and one last piece is sent to academic administration of faculty. Students are supposed to show their SAC in the previous semester in every consultation. SAC can only be printed in the end of semester after all courses score in that semester submitted to department/faculty.

### 3.4.2 Storage of All Evaluation Results/Student Evaluation

The need of student data runs for long time whether they still study in this university or not. Therefore, the storage of achievement data is supposed to be done by faculty. So, there must be a party to store the data. Some data that should be stored are:

1. List of student achievement for every course that is given by the lecturer.
2. SAC of student achievement and GPA. It includes all cumulative scores for all courses for the first to last semester.

## 3.5 Terminal of Study

A student can leave his study for a while (terminal) for maximal 2 years. It must be approved by University rector after the students study for at least two semesters. The terminal is not considered to determine the study period limit. If the terminal is caused by either university or government punishment, it is considered to determine the limit. A student can only ask the terminal twice and maximal two years. The request for terminal is addressed to the rector and must be submitted minimum one week after re-registration is closed.

### 3.6 Student Transfer

Brawijaya University only accepts student transfer from other universities for a study program that is appropriate and based on the availability of capacity. Students who transfer to UB are supposed to complete following requirements:

a. To complete administration requirements
b. To have a good academic record
c. Not pass over the study period limit in UB. It is counted in their previous university.
d. Never get academic or other punishments from previous university or government institution.
e. Leaving the previous university for not more than two years.
f. To take evaluation in the first two years and they are allowed to continue study by their previous university.

The student transfer inter-faculty in UB can complete above requirements. The transfer application is addressed to rector of university before even semester starts. The student transfer is arranged by specific regulation.

### 3.7 Student Exchange

Faculty of Mathematic and Natural Science accepts exchange students from government institutions by completing requirements as follow:

a. Coming from state university
b. Choosing the same department
c. Completing academic requirements and administrations
d. Availability of capacity

### 3.8 Academic Punishment

It is written on the University guidebook

## CHAPTER IV

## THE ORDER OF THE FACULTY OF MATHEMATICS AND NATURAL SCIENCE

### 4.1 General Rule

The big family of Faculty of Mathematics and Natural Sciences are:

1. Lecturer, permanent or temporary
2. Administration staff, such as technician and administration staff either civil servant or honorary
3. Student

### 4.2 Right and Duty

Right and duty for academic and administration staff are arranged on the written university guidebook.

- Student Rights

1. To receive education and learning according to the study program
2. To attend every academic activities arranged by faculty/university
3. To receive and use every facility based on the procedures and rules
4. To give suggestion and opinion constructively based on the valid rules, norms, characteristics and philosophy in Indonesia.

- Student Duties

1. To improve scientific societies who have good culture, apply Pancasila, and have Indonesian personality.
2. To strengthen and maintain the solidarity among big family in UB
3. To help and participate in every curricular program, co-curricular and extra curricular
4. To keep the integrity as graduate in the last study period. To obey the valid rules in faculty and university
5. To behave well, politely, and responsibly to big family of university and society

### 4.3 Relationship Ethics and Responsibility

1. The relationship ethics in this university is based on the family ethics and harmony as written on *Pancasila*.
2. Big family of faculty has responsibility to take care of the prestige of faculty and realize that university is part of the scientific society that will continuously improve as long as the development of science. It is the responsibility for all big family to keep the smoothness of learning process.

- Violation to Orders:

1. Having bad attitude that can worse the name of faculty
2. Having bad attitude that can worse the prestige of university/faculty officials
3. Misuse and pass over the rights that they have
4. Having ill-treatment and unfair personality
5. To leak the country's position and secret
6. Corruption for personal or group
7. To against and refuse duty

8. To make academic/non-academic activities difficult
9. To meddle in academic administration without faculty/university permission
10. To commit damage/dirty and falsify letter/document
11. To commit immoral acts
12. To misuse the name and symbol of university
13. To use facilities such as room, building, without permission
14. To commit blackmail, gambling and consume drugs, in university
15. To spread forbidden article or school
16. To set civitas academica in pit
17. Other forbidden acts

- Punishment

1. University members who commit crime and violation will receive punishment
2. Punishments are:
   a. Warning and admonition
   b. To give compensation and pay a fine
   c. Suspension
   d. Not allowed to attend academic activities in certain period or forever
   e. Their rights are taken and fired as part of university member

- Committee of Order Violation Consideration (PANTIB)

1. University members who commit violation will be processed by the committee that is made by rector regulation.
2. The members of committee consist of academic staffs that are instructed by rector by considering suggestion from Dean, for two-year position.
3. PANTIB deliver the investigation result to rector and the final decision is made by rector.

- Additional Rule
  University members who commit violation will be given right to defend their selves in oral or written appeal in the presence of rector before he gives final decision.

## CHAPTER V

## BIOLOGY DEPARTMENT

## 5.1 Background

Development of Biology as either pure or applied science to answer human problems is growing rapidly. Humanity and environment are becoming big issues nowadays, such as health, agriculture, farm, and environment degradation. Where people live, there problems exist. To anticipate and to reduce the negative effect as well as to continuously use natural resource, the necessity of science is important that is applied in education, research, and social service of Biology Department, UB.

Biology Department performs as education that produces graduates who have the mastery of Modern Biology concept and life skill. Therefore, Biology graduates are those called the Plus Biology Graduates. The modern Biology concept focuses on the principles and Contemporary Biology that contribute to the solution of Biology problems. Thus, through comprehensive concept understanding, students are able to have skill to solve Biology problems in today and future.

Graduates of Biology are significant to give good contribution to people. They can help development of technology and culture such as industries using fermentation, transgenic organism, bioremediation, purification and plant richness, animal cloning, etc. realization of sustainable development needs graduates mastering Biology.

Graduates of Biology must have a basic skill of Biology and soft/life skill. Knowledge of basic Biology covers the cellular and molecular, environment, function of structure and regulation, genetics, taxonomy and evolution. Soft skills that must be owned by graduates are good personality, confidence, work desire, communication, hard work, honesty, discipline, independent, creative and initiative. Those characters are considered as bio-entrepreneurship in Biology Department. Graduates should have those characters so that they can compete among job seekers.

## 5.2 Vision and Mission of Biology Department

Vision and mission of Biology dept were inspired by the awareness and hope for mega-diversity of natural resource available in Indonesia. Biodiversity potency in this country is so high yet the utilization is less. Besides, the biosphere change and man's intervention have caused species extinction. Therefore, the great challenge for biologist in the future is to conserve biodiversity and environment to support sustainable development.

The thought becomes an inspiration to make **vision**: to become a role model department that has Biology education according to the best international standard, a research place to develop modern Biology concept, and to have high awareness to conserve biodiversity, as well as to support applied sciences for the sake of human welfare.

Based on the vision, Biology has some missions to give the best service to East Java citizens, Indonesian people and mankind by providing good programs as follow:

1. To educate students to become graduates who have a thorough understanding of modern Biology concept and bio-conservation. Graduates must have good profile/academic

achievement, uphold ethics by respecting rights for life and be able to work together in the neighborhood.

2. To play an important role as a pioneer of education institution and research in Biology that can discover new knowledge, to participate actively in developing ideas and concept to support development of applied Biology such as agriculture, farm, fishery, medical, dentist and vet. Furthermore, graduates are expected to be able to serve education and skill of Biology. They can use their knowledge to help human welfare and environment conservation.
3. To become a pioneer that has high awareness and fast action to help biological problems faced by human.

### 5.3 Goals and Strategic Plans of Biology Department

Based on the visions and missions, Biology has some goals as follow:

a. To carry out undergraduate education that is efficient and relevant to teach students so that they can be graduates who are qualified, competent, out-standing and they can compete in either national or international job world.
b. To create conducive education atmosphere.
c. To complete internal management and organization.
d. To provide finance for laboratory enhancement, public service and national or international research.
e. To increase efficiency and productivity of facility for learning and research process.
f. To be competent in providing new innovation for people to increase their welfare.

By knowing vision, missions and goals presented, Biology Department evaluates and plans some strategies to reach those goals through RAISE strategies (Relevance, Atmosphere Academic, Internal Management, Sustainability, Efficiency and Productivity):

**A. Relevance**

1. Evaluation and structure of Biology curriculum that are based on bench-mark result in universities having international standard and high relevance with stakeholder and job market.
2. To increase relevance and finding of research (national /international) in stakeholder/institution competency.
3. To provide social service as the implementation of research finding.

**B. Academic Atmosphere**

1. To increase the effectiveness of communication between student and lecturer in academic activities (learning and thesis) and non academic activities (organization, sport, and open talk).
2. To increase the student participation in research, social service, publication, science competition and evaluation of lecture and study program.

**C. Internal Management**

1. To increase the role of Quality Assurance Unit by creating procedure manual and work instruction, to monitor them and to increase efficiency of information management.
2. To revise the study program management that can increase administration and staff quality by making ad hoc team.
3. To prepare the certification of administration management and laboratory.
4. To increase the efficiency of tracer study by communicating via phone and internet.

**D. Sustainability**

1. To cooperate with some institutions in Indonesia and other countries to develop quality and productivity of learning process.
2. To increase the number of research by letting the students to take part in writing final project.
3. To increase the number of public service that becomes the implementation of research.

**E. Efficiency and productivity**

1. To increase the facility maintenance for learning process.
2. To revise the academic rules to make the students graduate on the arranged time.
3. To enhance the number of scientific national and international journals.
4. To publish activity of civitas academica in media.
5. To increase the number of students who participate in scientific publication and scientific work competition.

**5.4 Organization Structure of Biology Department**

Head of Biology Department : Widodo, S.Si M.Si., PhD., Med Sc.
Secretary of Biology Department : Dr. Dra. Sri Widyarti, MSi.

**Quality assurance unit**

Head : Ir. Retno Mastuti, MAgrSc, DAgrSc.
Secretary : Dr. Drs. Suharjono, MSi.

| **Laboratory** | **Head of Laboratory** |
|---|---|
| Biology Basics | : Dra. Nunung Harijati, MS., Ph.D |
| Plant Taxonomy, Structure and Development | : Dr. Dra. Serafinah Indriyani, M.Si |
| Animal Physiology, Structure and development | : Muhaimin Rifai, Ph.D. Med. Sc |
| Plant physiology, Tissue Culture and Micro-technique | : Dr. Ir. Estri Laras Arumningtyas MScSt |
| Microbiology | : Dr. Suharjono, M.Si |
| Animal Ecology and Diversity | : Dr. Dra. Catur Retnaningdyah, M.Si. |
| Biology Cellular and Molecular | : Dr. Dra. Sri Rahayu, M.Kes |
| Computational Biology and Bioinformatics | : Brian Rahardi, MSc |

**Table 5.1 List of Biology lecturers and their academic field**

| No | Lecturer | Academic Field |
|---|---|---|
| 1 | Prof. Drs. Sutiman B. Sumitro, SU., D.Sc | Cell Biology and Nano-biology |
| 2 | Drs. Setijono Samino, MS, D.Sc | Eco-toxicology |

| No | Lecturer | Academic Field |
|---|---|---|
| 3 | Dr. Drs. Djati Batoro, MSi | Ethno-biology |
| 4 | Dr. Bagyo Yanuwiadi | Biological Control |
| 5 | Dra. Gustini Ekowati | Botany |
| 6 | Dr. Dra. Sri Rahayu, MKes | Animal Reproduction |
| 7 | Prof. Dr. Ir. Estri Laras A., MScSt | Plant molecular genetics |
| 8 | Dr. Drs. Suharjono, MSi | Environment Microbiology |
| 9 | Dr. Dra. Serafinah Indriyani, MSi. | Structure and Growth of Plant |
| 10 | Dr. Dra. Wahyu Widoretno, MSi | Plant Tissue Culture |
| 11 | Prof. Dra. Fatchiyah, M.Kes., PhD | Bio-mechanism and Nutrigenomic |
| 12 | Dr. Endang Arisoesilaningsih, MS | Plant Eco-physiology |
| 13 | Drs. Aris Soewondo, Msi | Animal Structure and growth |
| 14 | Ir. Retno Mastuti, MAgrSc, DAgrSc | Plant Tissue Culture |
| 15 | Dra. Nunung Harijati, MS., Ph.D | Plant Physiology |
| 16 | Dr. Dra. Catur Retnaningdyah, MSi | Aquatic Ecosystem |
| 17 | Dr. Dra. Sri Widyarti, MSi. | Cell Biology |
| 18 | Dra. Tri Ardyati, MAgr.Sc.,Ph.D | Applied Microbiology |
| 19 | Dr. Drs. Agung Pramana W.M., MSi | Animal Reproduction |
| 20 | Dra. Aminatun Munawarti, MSi | Plant Biotechnology |
| 21 | Drs. Sofy Permana, MSc.,DSc. | Molecular Biophysics |
| 22 | Dr. Ir. Moch. Sasmito Djati, MS | Embryo Manipulation |
| 23 | Rodliyati Azrianingsih, S.Si., MSc., Ph.D | Plant Systematic |
| 24 | Zulfaidah Penata Gama, SSi., MSi. , Ph.D | Entomology and Biological Control |
| 25 | Muhaimin Rifa'i, S.Si., PhD.Med.Sc | Immunology |
| 26 | Luchman Hakim, S.Si. MAgrSc., Ph.D | Conservation Area Management |
| 27 | Widodo, SSi., MSi., PhD.Med.Sc | Cancer Biology |
| 28 | Amin Setyo Leksono, S.Si., MSi., PhD | Entomology and Insect Ecology |
| 29 | Tegas Iman Prasojo, S.Si | Animal Taxonomy |
| 30 | Brian Rahardi, SSi. MSc | Computational Biology |
| 31 | Muhamad Imam, S.Si., M.Si | Vertebrate Taxonomy |
| 32 | Dr. Nia Kurniawan, MP | Vertebrate Taxonomy |
| 33 | Dian Siswanto, S.Si, M.Si., M.Sc | Plant Physiology |
| 34 | Yoga Dwi Jatmiko, SSi., MApp.Sc | Food Microbiology |
| 35 | Irfan Mustafa, SSi., M.Si | Environmental Microbiology |

### 5.5 Graduate Profile and Competency

#### 5.5.1 Profile

Biology Department is designed to produce graduates who understand modern Biology, apply their knowledge to solve human problems, willing to take a part in science development and have life skill. It aims to produce graduates who actively participate in works related to Biology. Therefore, graduates are expected to become (table 1):

1. Scientist / researcher who has knowledge of modern Biology and actively develops Biology, has sense to know technology development and human problems, gives consultation for planning and caring of natural resource use, conservation, etc.
2. Pioneer who cares for biological diversity with scientific research principles
3. Teacher/lecturer who can develop science and human resource through education
4. Staff in a state/private institution who can control the quality of product and management
5. Bio- entrepreneurship who can conduct researches and open job vocation related to Biology
6. Studying at higher level/degree to develop knowledge and academic status

Table 5.2 Graduate Profile at Biology Dept (2004-2010)

| Graduate Profile | Percentage (%) | |
|---|---|---|
| | 2004 | 2005-2010 |
| Researcher and consultant | 17,1 | 20,43 |
| Entrepreneur, Social worker who are aware of Biological Diversity with scientific research principle | 2,9 | 4,3 |
| Teacher/lecturer | 11,4 | 18,3 |
| Staff at Quality Control (QC) or Research & Development in industry | 8,6 | 21,5 |
| Government | 2,9 | 1,1 |
| Entrepreneur | 57,1 | 16,13 |
| Higher study (master's degree, etc) | 2,1 | 18,3 |

### 5.5.2 Graduate Competency

Learning at Biology Dept UB is conducted in comprehensive ways to support the competency in cognitive, psychomotor or affective (table 3). Cognitive aspect that can be made in learning process is the development of science and logical reasoning that can enhance Biology concepts and scientific thought. Psychomotor aspect that is given to students can provide some skills used at work in society such as understanding problems (understanding the fact, interpreting the data, deciding the procedure and method) and precision (acting well). All learning processes aim to produce young scientists who have good personality and success enthusiasm.

Table 3. Graduate Competency

| Cognitive, knowledge, intellectual quotient (I) | Affective, emotional quotient (A) | Psychomotor, skills (P) |
|---|---|---|
| I.1 understanding of role, and contribution of Biology, role of student, university and graduates, understanding the research method, and scientific writing | A.1 Scientific attitudes (curiosity, objective, rational, critical, open minded, innovative, hard worker, confident) | P.1 Good at choosing, applying research method and scientific report writing. |
| I.2 Mastering English language (reading, listening, speaking, and writing) | A.2 Uphold ethics (polite, honor others, control emotion, responsible, good listener) | p.2 Good at English language (reading, listening, speaking, and writing) |

| | | |
|---|---|---|
| I.3 Understanding of basic concept of modern Biology (up to date) including molecular Biology until community, Taxonomy, genetics, structure and function, ecology and evolution (microorganism to macroorganism) | A.3 Having bio-entrepreneurship spirit (leadership, management, self motivation, responsive, working in team and under pressure) | P.3 Good at operating basic computer for management filling, writing, analyzing data, preparing presentation, drawing objects, image analysis and searching information on internet and logarithm. |
| | | P.4 Mastering bioinformatics and computational Biology (analysis of biostatistics, clustering/coordination, genetics, phylogenetics) |
| I.4 Understanding of management related to research and development: self evaluation, planning, audit, standardization of procedure and work quality. | | P.5 good at practice as consultant, researcher, entrepreneur, environmental assessment. |
| I.5 Understanding of market need analysis for entrepreneur | A.4 Personal approach (being able to act a good role,) | P.6 good at Bioassay practice |
| | | P.7 good at analysis of market want for entrepreneur, marketing, and promotion |

### 5.6 Curriculum Structure

Curriculum of undergraduate education in Biology (academic program) that is designed for 8 semesters or 4 years study. This curriculum focuses on mastering, applying or developing science. It is different from other professional education that focuses on applying on graduates' certain skill. By mastering analysis mind, undergraduates are not young 100 % (Sutrisno, 2000. *Kurikulum Pendidikan Tinggi di Indonesia untuk Abad 21*. Dirjen Dikti. Departemen Pendidikan Nasional RI.), but they still need to have more quality in work field or higher education. Ability of analytical mind based on modern Biology concept will provide undergraduate that have high adaptability for work field, diversity, and competition in era change.

Quality of graduates is determined by the effectiveness of learning process, so manual of education in the form of curriculum must be designed according to paradigm telling that learning begins with mastering basic concept to go complexity of multi sciences (figure 1). List of competency developed through curriculum is described in subjects presented in class during semester. Hopefully, in the end of learning, this curriculum can deliver graduates to have high academic potency, spiritual, professional, and competitiveness in society.

**Curriculum Structure of Biology is described below:**

**Semester 1: basic science to support the Biology concept understanding and success skill**

- Basic science that supports the understanding Biology concept in the next years: general Biology, Physics, Chemistry, English language, basic computation and research method writing.
- Success skills are *leadership, bio-entrepreneurship spirit*, some ways to become great students at UB and great people in society, ways to know student's role, ways to study at university, consequence to become scientific society, ways of success to improve global competence and human welfare.

**Semester2-4: Structure, function and organization of life in qualitative and quantitative**

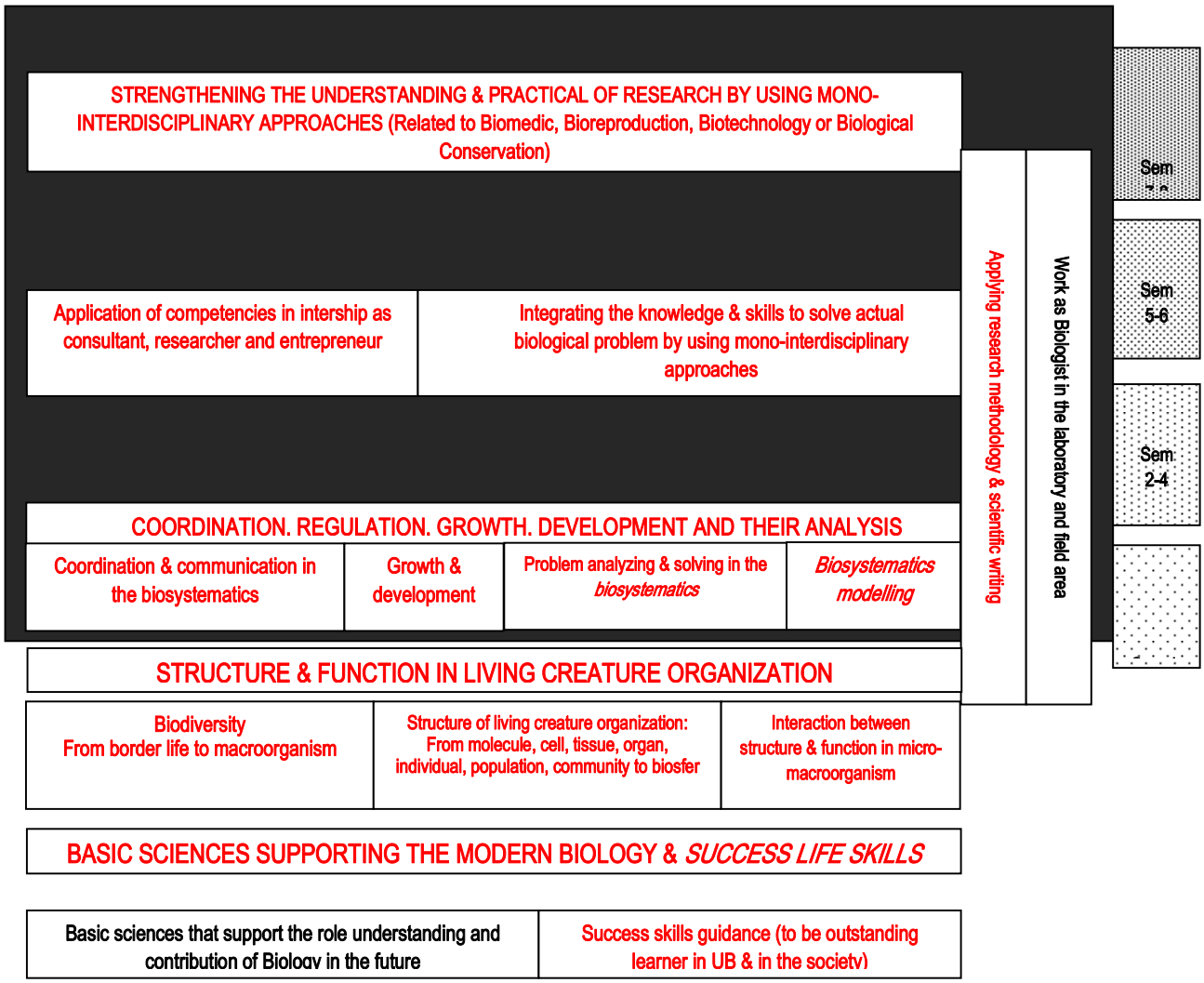
- Diversity from *border life* to microorganism: biodiversity, biosystematics (description, identification, classification, nomenclature, and phylogenetics) and contribution of Virus, Bacteria, Protysta, Fungus, Plantae (Cryptogamae, Phanerogamae) and animal (Protozoa, Metazoa).
- Structure of biosystem from cellular, molecular, tissue, organ to biosphere.
- Interaction of structure and function of macro-microorganism: contribution of structure, organization and physiology function mechanism of microorganism to macroorganism.

**Semester 5-6: coordination and regulation of growth-development and the analysis**

- Coordination, regulation and communication of biosystem: mechanism and contribution of some coordination, regulation, and communication at cell level to individual at micro and macroorganism.
- Growth and development: character and factor (internal and external) that influence the process of growth, development, reproduction and death.
- Analysis technique for the problems and the solutions in biosystem: a technique used to detect symptom and analysis of cause of *malformation, disfunction*, infection and Biology finding used to solve the problems.
- Modeling in biosystem: collecting, managing, and analyzing data (qualitative, quantitative, category, numeral, picture) to arrange the model of biosystem and its application (design, tendency prediction and conclusion).

**Semester 7-8: Understanding well and internship of Biology by using multidisciplinary approach**

- Integration of competency to solve Biology problems: Widening competency by providing multidisciplinary courses to develop soft skill, nationalism and humanistic approach.
- Application of competency in internship can be as a researcher, entrepreneur, and consultant: utilization of understanding and skill to solve problems or to make business.




**Picture 1. Curriculum structure of Biology Department, UB**

### 5.7 Research Group/Working Group

There are two categories of working group; ***Bioconservation*** and ***Bioengineering.*** Every category has interest, group of expertise, and research theme. Each group of expertise is led by a professor or Head Lector (Doctor) to improve the researches based on the target goal of expertise group. Each group has developed the strategy *resource sharing* with other groups in Biology Dept or other institutions. Therefore, the research finding is efficiently and optimally used. By joining the working group, students are expected to conduct their research well, to get sufficient supervise and to achieve a good result.

**Table 3. Interest Field/Working Group at Biology Department**

| Interest | Research theme | Researcher |
|---|---|---|
| **Interest: Biodiversity Conservation/Bioconservation (BC)** | | |
| BK-1 | 1. Study on Bio-remidiation technology development<br>2. Food Microbiology<br>3. Bio-fertilizer | 1. Dr. Suharjono, MS.<br>2. Tri Ardyati, MAgr., Ph.D.<br>3. Irfan Mustafa, M.Si.<br>4. Yoga Dwijatmiko, M.Sc. |
| BK-2 | 1. Tropic ecosystem conservation<br>2. Insect ecology and development habitat model management (agro-ecosystem conservation)<br>3. Landscape management<br>4. Bio-systematic | 1. Dr. Endang Arisoesilaningsih, MS<br>2. Dr. Bagyo Yanuwiadi<br>3. Amin Setyo Leksono, S.Si.,MSi., Ph.D<br>4. Nia Kurniawan, S.Si., MSi., Ph.D<br>5. Dr. Catur Retnaningdyah<br>6. Drs. Setijono Samino, Ph.D<br>7. Zulfaidah Penata Gama, S.Si., M. Si<br>8. Tegas Iman Prasojo, S.Si.<br>9. Muhammad Imam, S.Si |
| **BK-3** | 1. Analysis on genes diversity of plant resources<br>2. Plant physiology | 1. Dr. Estri Laras Arumningtyas<br>2. Dr. Wahyu Widoretno, MS<br>3. Retno Mastuti, MAgrSc., D.AgrSc<br>4. Nunung Harijati, MS., Ph.D<br>5. Dr. Serafinah Indriyani, M.S.<br>6. Dra. Aminatun M., M.Si.<br>7. Dian Siswanto, S.Si |
| **BK-4** | 1. Development of animal reproduction technology<br>2. Analysis on genetic diversity related to fertility<br>3. Manipulation on embryos and stem cells<br>4. Manipulation on fish reproduction | 1. Dr. Ir. M. SasmitoDjati, MS<br>2. Dr. Sri rahayu, M.Kes<br>3. Dr. Agung Pramana Warih Mahendra<br>4. Drs. Aris Suwondo, M.Si. |
| **BK-5** | 1. Analysis on macro/microscopic organ structure of vegetative and reproductive plant, Cryptogamae and Phanerogamae which has good potential and economical value<br>2. Ethnobotany and variability of morphology Amaranthaceae<br>3. Analysis of population condition and variability of morphology Amorphallus muelleri | 1. Dr. Serafinah Indriyani, M.Si. (Structure and Growth of Plant)<br>2. Dr. Jati Batoro, M.Si. (Ethnobiology)<br>3. Rodliyati Azrianingsih, S.Si., M.Sc., Ph.D. (Plant Taxonomy)<br>4. Luchman Hakim, S.Si., M.Agr.Sc., D.Agr.Sc. (Ethnobotany and Ecotourism)<br>5. Brian Rahardi, S.Si., M.Sc. (Plant Mapping)<br>6. Dra. Gustini Ekowati (Plant Taxonomy) |
| **Interest: Bioengineering (BE)** | | |
| **BE-1** | 1. Study on cellular biology and cancer molecules<br>2. Immune-contraception and medical diagnostic technology<br>3. Innovation of nano-science on cigarette smoke (divine smoke) | 1. Prof. Sutiman Bambang Sumitro, Drs., SU., D.Sc.,<br>2. Dra . Dr Sri Widyarti, MSi<br>3. Sofi Permana, S.Si., M.Sc.,D.Sc. |
| **BE-2** | 4. Study on monoclonal Antibody<br>5. Study on autoimmune of molecular level | 1. Muhaimin Rifai, S.Si., Ph.D. Med.Sc |

| Interest | Research theme | Researcher |
|---|---|---|
| **BE-3** | 1. Study on nutrigenomics<br>2. Bio-informatics | 1. Fatchiyah, Dra., M. Kes..,Ph.D.<br>2. Widodo, S.Si., MSi., Ph.D. Med.Sc. |

**COURSES DISTRIBUTION OF BIOLOGY DEPARTMENT**

**COMPULSORY COURSES**

**ODD SEMESTER**

| No | Course Code | Course | Activity (SCS) | | | Status | Prerequisite |
|---|---|---|---|---|---|---|---|
| | | | Total | Lecture | Practice | | |
| 1 | MAB4100 | General Biology | 3 | 2 | 1 | W | |
| 2 | MAI4180 | General Computer | 3 | 2 | 1 | W | |
| 3 | MAK4103 | Chemistry | 2 | 2 | 0 | W | |
| 4 | MAK4102 | Lab. Work Chemistry | 1 | 0 | 1 | W | |
| 5 | MAP4190 | Physics | 3 | 2 | 1 | W | |
| 6 | MAP4191 | Lab. Work Physics | 1 | 0 | 1 | W | |
| 7 | MAM4190 | Mathematics | 3 | 3 | 0 | W | |
| 8 | MAS4180 | Statistics | 3 | 2 | 1 | W | |
| 9 | MAB4101 | Meth. Of Bio. Research & Scientific Writ. | 2 | 2 | 0 | W | Must be taken at 1st semester |
| 10 | MAB4160 | Cell Biology | 3 | 2 | 1 | W | MAB100 |
| 11 | MAB4121 | Microtechnique | 3 | 1 | 2 | W | MAB4216<br>MAB4231 |
| 12 | MAB4173 | Ecology | 4 | 3 | 1 | W | MAB4271<br>MAB4213 |
| 13 | MAB4137 | Animal Anatomy and Histology | 4 | 3 | 1 | W | |
| 14 | MAB4162 | Molecular Biology | 2 | 2 | 0 | W | MAB4261 |
| 15 | MAB4143 | Biostatistics | 3 | 2 | 1 | W | MAS4180 |
| 16 | MAB4138 | Animal Embryology | 3 | 2 | 1 | W | MAB4137 |
| 17 | UBU4005 | Entrepreneurship | 3 | 1 | 2 | W | |
| 18 | UBU4004 | English | 3 | 3 | 0 | W | |
| 19 | UBU4008 | Indonesian Language | 3 | 3 | 0 | W | |
| 20 | UBU4009 | Field Work Practice (internship) | 3 | 0 | 3 | W | ≥90 SKS |
| 21 | UBU4002 | Participatory Community Development | 3 | 0 | 3 | W | ≥108 SKS |
| 22 | MAB4005 | Research Proposal Seminar | 1 | 0 | 1 | W | ≥108 SKS, supervisor has been determined |
| 23 | MAB4006 | Research Progress Seminar | 1 | 0 | 1 | W | ≥108 SKS |
| 24 | UBU4001 | Final Project | 6 | 0 | 6 | W | ≥120 SKS |

**EVEN SEMESTER**

| No | Course Code | Courses | Activity/SKS | | | Status | Prerequisite |
|---|---|---|---|---|---|---|---|
| | | | Total | Lecture | Practice | | |
| 1 | MAB4202 | Methods of Bioresearch & Scientific Writing 2 | 2 | 2 | 0 | W | MAB4101 must be taken at 6th semester |
| 2 | MAB4213 | Plant Systematic | 3 | 3 | 0 | W | |
| 3 | MAB4214 | Lab. Work Plant Systematic | 2 | 0 | 2 | W | |
| 4 | MAB4271 | Animal Systematic | 3 | 3 | 0 | W | |
| 5 | MAB4275 | Lab. Work Animal Systematic | 2 | 0 | 2 | W | |
| 6 | MAB4216 | Plant Structure and Development | 3 | 3 | 0 | W | |
| 7 | MAB4217 | Lab. Work Plant Structure | 2 | 0 | 2 | W | |
| 8 | MAB4231 | Animal Histology | 2 | 1 | 1 | W | |
| 9 | MAB4241 | Biochemistry and Instrumentation | 3 | 2 | 1 | W | |
| 10 | MAB4220 | Plant Physiology | 4 | 3 | 1 | W | MAB4216 MAB4160 MAB4241 |
| 11 | MAB4276 | Biodiversity Conservation | 6 | 4 | 2 | W | MAB4173 |
| 12 | MAB4261 | Genetics | 4 | 3 | 1 | W | MAB4241 |
| 13 | MAB4250 | General Microbiology | 4 | 2 | 2 | W | MAB4140 MAB4239 |
| 14 | MAB4203 | Evolution | 2 | 2 | 0 | W | |
| 15 | UNG4007 | Citizenship | 3 | 3 | 0 | W | ≥54 SKS |
| 16 | UBU4001 | Religion | 3 | 3 | 0 | W | |
| 17 | UBU4005 | Entrepreneurship | 3 | 1 | 2 | W | |
| 18 | UBU4005 | English | 3 | 3 | 0 | W | |
| 19 | UBU4008 | Indonesian Language | 3 | 3 | 0 | W | |
| 20 | UBU4009 | Field Work Practice (internship) | 3 | 0 | 3 | W | ≥90 SKS |
| 21 | UBU4002 | Participatory Community Development | 3 | 0 | 3 | W | ≥108 SKS |
| 22 | MAB4005 | Research Proposal Seminar | 1 | 0 | 1 | W | ≥108 SKS Supervisor has been determined |
| 23 | MAB4006 | Research Progress Seminar | 1 | 0 | 1 | W | ≥108 SKS |
| 24 | UBU4001 | Research Project | 6 | 0 | 6 | W | ≥120 SKS |

**Optional Courses**

**Odd Semester**

| No | Course Code | Courses | Activity (SCS) | | | Status | Prerequisite |
|---|---|---|---|---|---|---|---|
| | | | Total | Lecture | Practice | | |
| 1 | MAB4004 | Special Topic for Research Project | 3 | 0 | 3 | P | ≥90 supervisor has been determined |
| 2 | MAB4154 | Food Microbiology | 4 | 2 | 2 | P | MAB4250 |
| 3 | MAB4155 | Environmental Microbiology | 3 | 2 | 1 | P | MAB4250 |
| 4 | MAB4133 | Animal Cell and Tissue Culture | 3 | 2 | 1 | P | MAB4137 |
| 5 | MAB4123 | Plant Tissue Culture | 3 | 2 | 1 | P | MAB4220 |
| 6 | MAB4179 | Biological Control | 4 | 2 | 2 | P | MAB4173 |
| 7 | MAB4172 | Aquatic Ecosystem Management | 3 | 2 | 1 | P | MAB4173 |
| 8 | MAB4111 | Ethnobotany | 2 | 2 | 0 | P | MAB4213 MAB4276 |
| 9 | MAB4127 | Phytohormone | 3 | 2 | 1 | P | MAB4220 |
| 10 | MAB4007 | Survey and Data management on Natural Resources | 4 | 1 | 3 | P | MAB4276 |
| 11 | MAB4139 | Immunology | 3 | 3 | 0 | P | MAB4137 |
| 12 | MAB4112 | Medicinal Herb | 2 | 2 | 0 | P | |
| 13 | MAB4164 | Genetics Population | 2 | 2 | 0 | P | MAB4261 MAB4173 |
| 14 | | Optional courses from Law Faculty and Agricultural Technology faculty. | | | | P | *) |

***) maximum limit for optional courses from law faculty and agricultural technology faculty is total ¼ from total optional courses that are taken (6-7 SCS)**

**Optional Courses**

**Even Semester**

| No | Course Code | Courses | Activity (SCS) | | | Status | Prerequisite |
|---|---|---|---|---|---|---|---|
| | | | Total | Lecture | Practice | | |
| 1 | MAB4004 | Special Topic For | 3 | 0 | 3 | P | ≥90 supervisor |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | Research Project | | | | | has been determined, GPA≥2,0 is not programmed in the same semester with MAB4005 |
| 2 | MAB4263 | Analytical Technique of Molecular Biology | 4 | 2 | 2 | P | MAB4261 |
| 3 | MAB4277 | Ecotoxicology | 3 | 2 | 1 | P | MAB4173 |
| 4 | MAB4278 | Social Ecology | 2 | 2 | 0 | P | |
| 5 | MAB4221 | Plant Biotechnology | 3 | 2 | 1 | P | MAB4261 |
| 6 | MAB4234 | Animal Bioreproduction | 3 | 2 | 1 | P | MAB4137 |
| 7 | MAB4235 | Vaccine Engineering | 2 | 2 | 0 | P | MAB160 MAB4137 MAB4139 |
| 8 | MAB4253 | Industrial Microbiology | 3 | 2 | 1 | P | MAB4250 |
| 9 | MAB4236 | Ornitology | 3 | 2 | 1 | P | |
| 10 | MAB4251 | Microbial Diversity | 3 | 2 | 1 | P | MAB4250 |
| 11 | MAB4279 | Computational Biology | 3 | 1 | 2 | P | MAB4100 MAI4280 |
| 12 | MAB4265 | Bioinformatics | 3 | 1 | 2 | P | MAB4261 MAI4280 |
| 13 | MAB4240 | Introduction to Biophysics | 3 | 2 | 1 | P | |
| 14 | | Optional courses from Law Faculty, Agricultural Technology | | | | P | *) |

***) maximum limit for optional courses from law faculty and agricultural technology is total ¼ from total optional courses that are taken (6-7 SKS)**

**COURSE SYLLABUS AT BIOLOGY DEPARTMENT**

**GENERAL BIOLOGY (MAB4100) 3 (2-1) sks**

Prerequisite : -

**BRIEF DESCRIPTION** :

General Biology discusses about significant contribution of Biology in forming point of view and knowledge as well as presents development of Biology in contribution of science and technology today. The comprehension is showed by presenting scientific researches and technology.

**GOAL** :

Students can explain some examples of modern Biology and its application in supporting the development of applied science, to solve problems related to Biology. Besides, they are able to explain the contribution and reason of mastering Biology and also to improve skills as a young generation in scientific society who are able to improve and to communicate.

**TOPIC** :

Development of Biology contribution in global era through some modern Biology concepts in some fields becomes the foundation of bio entrepreneur such as a) significant contribution of diversity to biosphere conservation. b) enhancement of cellular molecular Biology and anatomy in diagnostic and therapy, extinction, and new material source, c) contribution of genetics to solve reproduction problems, purification and growth of microorganism, plant and animal, d) innovation of tissue culture technique for animal and plant to fulfill any necessity, e) contribution of ecology concept in protection and damaged ecosystem rehabilitation. Topics for lab work are based on lecture topic. Besides, technique of microscope usage as one of the basic skills is presented in lab work.

**LEARNING STRATEGY** :

Lecture, lab work, quiz, assignments, presentation, discussion, student centered learning (SCL) and collaborative learning.

**REFERENCES** :

Shantharam, S. & J.F. Montgomery. 1999. *Biotechnology, Biosafety and Biodiversity*. Science Publ. USA; Barbosa, P. 1998. *Conservation Biological Control*. Academy Press Limited. UK; Campbell, N.A., Mitchell L.G., & Reece J.B. 1994. *Biology: Concept and Connections*. Benjamin/Cummings Publ. Co.Inc. New York.; Solomon, E.P., Berg L.P., & rdMartin D.W., Ville C. 1991. Biology. 3 ed. Saunders College Publ. Florida; Starr, C. & thTaggart R. 1990. *Biology: The Unity and Diversity of Life*. 7 ed. Wadsworth Publ. Co. San Francisco

**GENERAL COMPUTER (MAI 4280) 3(2-1) credits**

**Prerequisite** : -

**BRIEF DESCRIPTION** :

This course covers the explanation of algorithm introduction, basic data type, computer finishing step, flowchart and pseudo code, statement IO, selection, iteration, array, string, file operation and Pascal/Delphi.

**GOALS** :

Students are able to explain algorithm design and implementation to programming language that is relevant in Biology. Besides, students can develop their computer skill, information system and application system.

**TOPIC** :

Algorithm introduction, basic data type, finishing by computer, flow chart and pseudo code, statement IO, selection, iteration, array, string, file operation and Pascal/Delphi

**LEARNING STRATEGY** :

Lecture, lab work, quiz, assignment, presentation, discussion and *student centered learning* (SCL)

**REFERENCES** :

Horowitz, E. 1988. *Fundamental of Computer Algorithms*. ; Munir, R. 2000. *Algoritma dan Pemrograman*. IF Bandung.; Kadir, A. 1999. *Pemrograman TRubo Pascal* Elexmedia Komputindo.

**CHEMISTRY (MAK 4101) 2 (2-0) credits**

**Prerequisites : -**

**BRIEF DESCRIPTION :**

This course presents the contribution of chemistry in life, chemistry laws, development of atom structure and periodic system, molecule character, law concept of chemical thermodynamics I, II and III and its application, diagram of phase and substance, concept and character of liquid and colloid, chemical kinetics concept, chemical balance concept and some factors that influence it.

**GOAL :**

Students are expected to be able to explain stoikiometric, atom and molecule structure, thermodynamics, liquid and colloid as well their characters, chemistry balance concept, and factors that influence it.

**TOPIC :**

Introduction (chemistry in this life, the needs of chemistry for physics, System of Units), stoikiometric (definition of atomic mass, mole concept, molecular formula making, chemical reaction, and reaction efficiency), atomic structure and periodic system, structure of molecule and chemical bond, chemical thermodynamics (law I, II and III), chemical kinetics, liquid and colloid and chemical balance.

**LEARNING STRATEGY :**

Lecture, quiz, assignment, presentation and discussion, and student centered learning (SCL)

**REFERENCES :**

Chang, R., 2006, *Chemistry*, 9th Ed., Mac Graw-Hill inc., New York.; Whitten K.W., th Davis R.E., Larry Peck M., Stanley G.G., 2004, *General Chemistry*, 7 Ed., Brooks/Cole, USA.; Oxtoby D.W, Gillis H.P., Nachtrieb N.H., (Penerjemah: Suminar Setiati Achmad), 2001, *Prinsip-Prinsip Kimia Moderen*, Edisi keempat, Penerbit Erlangga, Jakarta.; Petrucci, R.H., Harwood, W.S., Herring, G.E., Madura, J.; 2007, *General Chemistry: Principles and Modern Application*, Prentice Hall, 2007.

**LAB WORK OF CHEMISTRY (MAK4102) 1 (0-1) credits**

**Prerequisites : -**

**BRIEF DESCRIPTION :**

This course explains the use of tools and materials in chemistry laboratory, procedures of chemistry experiment, procedures to examine chemical change and way of counting experiment data.

**GOAL :**

Students are expected to be able to obtain experiment how to do experiments and examining chemical indication, good at using tools at laboratory, chemical material, analyzing data, writing report and getting motivation to do experiment.

**TOPIC :**

Introduction of tools and chemical material, introduction (chemical reactions) of electrical conductivity, liquid solidification, *volumetric* analysis, calorimetric analysis, solvent extraction and redox reaction.

**LEARNING STRATEGY :**

Lab work and discussion

**REFERENCES :**

Slowinski E.J., Wolsey W.C., Masterson W.L., 2005, *Chemical Principles in the Laboratory*, 8 Ed., Brooks/Cole, USA.; Slowinski, Wolsey, Masterton, 1997, *Chemical Principles in the Laboratory with Qualitative Analysis*, 6th Ed., Brooks/Cole, USA.; Weiss,G.S., Greco,T.G., Rickard,L.H., 2007, *Experiments in General Chemistry*, Prentice Hall.; Robert J. L., 2004, *Chemistry in the Laboratory*, 6th spiral edition, W.H. Freeman

**PHYSICS (MAP 4190) 2 (2-0) Credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course describes some concepts of basic Physics and its relevance to understand Biology phenomena and get in to the development of science and technology, such as: system of units, Newtonian mechanics, linear momentum, torka, and corner, mechanics of rigid body, power and energy, dynamic and static fluid, harmonic oscillation, mechanics and electromagnetic wave, geometrical optics.

**GOAL :**

Students are expected to explain some basic concepts of Physics and its relevance to support development of modern Biology. Besides, students can increase basic skill in doing measurement, using instruments, computation system, information and bioassay system.

**TOPIC :**

Basic concept of Physic, unit system, Newton mechanics, linier momentum, torka, and corner, mechanics of rigid body, power and energy, dynamic and static fluid, harmonic oscilation, wave of mechanics and electromagnetic, geometric optics.

**LEARNING STRATEGY :**

Lecture, quiz, assignment, presentation and discussion, and *student centered learning* (SCL)

**REFERENCES :**

Resnick & Halliday, *PHYSICS Extended with Modern Physics*, John Wiley & Sons, 1992. P.A. Tipler, *Physics for Scientists and Engineers*, 5th edition.

**LAB WORK OF PHYSICS (MAP 4191) 1 (1-0) credits**

**Prerequisites : -**

**BRIEF DESCRIPTION :**

In this lab work, there will be explanation about measuring tool usage of mechanical quantity, electricity, and heat, correction theory, graphic making procedure, and data analysis for writing report.

**GOAL :**

Students are able to measure quantity such as (mechanics, wave, electrics, magnetic, optic), to analyze data in scientific paper.

**TOPIC :**

Measurement and correction, falling body movement, liquid viscosity, sound resonance, measurement of bias index of sugar solution, Ohm law, Kirchoff law, and magnet field.

**LEARNING STRATEGY :**

Lab work and response

**REFERENCES :**

Darmawan, D., 1985, *Teori Ketidakpastian*, Penerbit ITB, Bandung.; Sears F.W., Zemansky M.W., 1989, *Fisika untuk Universitas, Penerbit Bina Cipta*, Bandung.; Paul A. Tippler, 1991, *Physics for Scientists and Engineers, Worth Publisher*.; Halliday D., R. Resnick, 1985, Physics, Erlangga, Jakarta

**MATHEMATICS (MAM 4190) 3 (3-0) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course describes the function, continuity, extreme value, limit, function derivative, derivative usage (Limit with L'Hospital and Max-minimal of function), Indefinite Integral, definite integral, algorithm function and exponential, trigonometry, and matrix (Linear Equation System).

**GOAL :**

Students are able to explain and apply basic principles of function, continuity, extreme value, limit, function derivative, derivative usage (limit and max and min function), irregular integral, regular integral (unlimited border), algorithm function and exponential, trigonometry, and matrix (linier system).

**TOPIC :**

Function, continuity, extreme value, limit, function derivative, derivative usage (limit and max and min function), irregular integral, regular integral (unlimited border), algorithm function and exponential, trigonometry, and matrix (linier system).

**LEARNING STRATEGY :**

Lecture, quiz, assignment, presentation and discussion, and student centered learning (SCL)

**REFERENCES :**

Purcell, E. 1985. *Kalkulus dan Geometri Analitis,* Erlangga.thRaiville, E. D. 1974. *Differential Equations*. 5 Ed. McMillan. New York. Illdebrand, F. B. 1963. *Advanced Calculus for Applications. Prentice-Hall Inc*. New York

**STATISTICS (MAS 4180) 3 (2-1) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

Students are supposed to be able to explain the basic concept of statistics, descriptive statistics, basic probability theory, expected value and mode, discrete and continue probability, parameter presumptive, hypothesis test, one-two way classification, regression and correlation, analyzing data using statistics program in PC (Genstat).

**GOAL :**

Students will be able to design Biology research/bio-entrepreneur based on basic principles of statistic analysis either manually or using computer.

**TOPIC :**

Basic concept, descriptive statistics, basic probability theory, expectation value and mode, discrete and continue probability, parameter presumptive, hypothesis test, one-two way classification, regression and correlation, analyzing data using statistics program in PC (Genstate).

**LEARNING STRATEGY :**

Class meeting, assignments, quiz and lab work.

**REFERENCES :**

Bhattacharryya, G.K. & R.A. Johnson. 1977. *Statistical Concepts and Methods*. John Wiley, New York.; Walpole, R.E. 1976. *Elementary Statistical Concepts*. MacMillan Pub.Co. New York.; Sokal, R.R. & J.vRohlf. 1981. *Biometry: The Principles and Practice of Statistical in Biological Research*. W.H. Freeman & Co. New York.

**BIOLOGY RESEARCH METHOD AND SCIENTIFIC WRITING 1 2 (2-0) credits (MAB4101)**

**Prerequisite** **: -**

**BRIEF DESCRIPTION** **:**

This course explains the Biology research method and ways of scientific writing.

**GOAL** **:**

Students can write scientific work in the form of lab work report, assignments and poster. They can also take part in science forum as a speaker or participant.

**TOPIC** **:**

Technique of selection, reading and taking reference, some of basic methods, research kinds and design, language style in writing scientific work and scientific popular, how to write lab work and research report consist of : background, reference, and research/lab work method, resenting the data (picture and table), writing of finding and discussion, reference, scientific work (LKTM new students)

**LEARNING STRATEGY** **:**

Research method topic is delivered by using power point and LCD. Assignments are given in class to train students in scientific work writing and research method. To know students' comprehension, lecturers give quiz and exam.

**REFERENCES** **:**

Routledge, P. 2001. *Science and technical writing: a manual of style*. Routledge. New York.; Howard, K and Sharp, J.A., J. Peters dan K. Howard. 2002. *The Management of a Student Research Project*. Gower Publ. Cambridge.; Matthews, J.R. dan R.W. Matthews. 2008. *Successful Scientific Writing*. Cambridge Univ. Press. Cambridge.; Nazir, M. 1988. Metode Penelitian. Ghalia Indonesia, Jakarta.; Suriasumantri, J.S. 1981. *Ilmu dalam Perspektif.* Gramedia. Jakarta.

**CELLULAR BIOLOGY (MAB4160) 3 (2-1) credits**

**Prerequisite** **: MAB4100**

**BRIEF DESCRIPTION** **:**

This course describes the cellular as experiment model, mechanism of cell activity in term of cellular and molecular.

**GOAL** **:**

Students are able to explain and analyze the mechanism of cell in term of cellular and molecular.

**TOPIC :**

1) introduction: cell for experiment model, learning technique, basic concept to think in physics and chemistry way when analyzing about cell Biology (2) experiment method to analyze cell Biology (3) cell membranes (4) intracellular molecular transport: (5) cytoskeleton and mechanism of movement molecular inside cell (6) cell signal (7) cell cycle: G1, G2, S, M (mytosis and meiosis) (8) cell polyferation (9) cell death

**LEARNING STRATEGY :**

Lecture, lab work, quiz, assignment, presentation, discussion and student centered learning (SCL).

**REFERENCE :**

Rd Cooper, G.M. and Hausman, R.E., 2004, *The Cell A Molecular Approach*, 3 ed., Sinauer Associates, Inc., Massachusetts; Becker, W.M., Kleinsmith, L.J., and Hardin, J., 2000, *The World of The Cell,* 4 ed., Addison Wesley Longman, Inc.

**MICROTECHNIQUE (MAB 4121) 3 (1-2) credits**

**Prerequisite : MAB4216, MAB4231**

**BRIEF DESCRIPTION :**

This course explains the making of Biology microscopic slide of animal and plant tissue in non-permanent (fresh blood smear), semi permanent (whole mount, squash) and permanent (paraffin).

**GOAL :**

Student can explain and apply the method of microscopic slide making from animal and plant tissue.

**TOPIC :**

INTRODUCTION: benefit of micro-technique and introduction of safety data sheet, collection and tissue preparation, basic principles and technique: fixation and fixative, dehydration, purification, infiltration, embedding and slicing; coloring and color material, special technique: smear, squash and maceration; microtom type and its usage; method for material and special purpose: whole mount.

**LEARNING STRATEGY :**

Lecture, lab work, assignment, presentation and class discussion. Material of micro-technique is written on power point.

**REFERENCES :**

Brown, G.G. 1970. *An Introduction to Histotechnology*. Appleton Century Crafts. New York.; Horobin, R.W. & J.A. Kierman (Eds.). 2002. *Conns Biological Stains*. Tenth Edition. BIOS Scientific Publishers. Oxford.; Khasim, S.M. 2002. *Botanical Microtechnique*: Principles and Practice. Capital Publishing Company. New Delhi.

**ECOLOGY (MAB4173) 4 (3-1)**

**Prerequisite** **:** MAB4271, MAB4213

**BRIEF DESCRIPTION** :

This course presents the definition and scope of ecology starting from population organization to ecosystem. It describes and analyzes the population characteristic, community, interaction among population, non-biotic factor, interaction between biotic and non-biotic factor, food chain, ecosystem and energy flow.

**GOAL** **:**

Students are expected to be able to explain, describe and analyze the limitation, scope and concepts in ecology. Students have skill to observe phenomena of ecology by using technique of ecology analysis and laboratory equipments.

**TOPIC** **:**

Definition and scope of ecology, law of minimum, tolerance prediction and non-biotic factors of environment, habitat, acclimatization, and niche ecology. Structure, growth and estimation of population and patterns of population spread, population regulation, interaction of intra/inter population and population stability. Basic of molecular ecology, characteristics, structure and community classification. Concept of similarity and community similarity, concept of continuity and discontinuity. Change on community. Edge effect, ecotone in habitat fragmentation. Kinds, characteristics, mechanism of succession, and climax concept. Home range and territoriality, respond of energy transformation, tropic level and flow of energy. Value of nutrient, digested ability and food availability. Efficiency of ecology and structure of ecology pyramid. Predator, parasitocyte, and polyfag. Effect of predation on community structure, analysis of predation model to Biology control. Freshwater, sea, and estuary ecosystem. Terrestrial ecology. Evolution ecology; biosphere evolution and ecosystem. Nature selection, selection r and k, niche segregation, speciation and diversity of species, sympatric and allopatric speciation. Management of ecology system; concept of natural resource management and river area. Environment pollution.

**LEARNING STRATEGY** **:**

Lecture, lab work, quiz, assignment, presentation, and discussion. Student Centered Learning (SCL), collaborative learning. Evaluation: assignment, quiz and exams, presentation, discussion.

**REFERENCE :**

Krohne, D.T. 2001. *General Ecology*. 2nd Edition. Brooks/Cole Thompson Learning, Inc. USA. Osbore, P.L. 2000. *Tropical Ecosystems & Ecological Concepts.* First Published. Cambridge Univ. Press, Cambridge. Molles, M.C. 2002. *Ecology. Concepts and Applications*, 2nd Ed. McGraw-Hill, Boston. Odum, E.P. 1971. *Fundamentals of Ecology*. 3rd ed. W.B. Saunders Co. London; Colinvaux, P., 1986. Ecology. John Wiley and Sons. New York; Krebs, C.J. 1978. *Ecology of the Experimental Analysis of Distribution and Abundance.* 2nd ed. Harper and Row Publishers. New York; Krebs, C.J., 1989, *Ecological Methodology,* Harper and Row Publishers, New York; Brower, J.E., Zar J.H. & C.N. von Ende. 1990. *Field and Laboratory Methods for General Ecology*.3rd ed. W.C. Brown Publishers, Dubuque.

**ANIMAL ANATOMY-PHYSIOLOGY (MAB4137) 4 (3-1) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course contains of cell, tissue, organ position and organ system that become manifestation of life. It includes the explanation of structure and function of cell, tissue, organ, and organ system. Principally, this subject is divided into 5 parts: 1. Structure of animal body (man), 2. Moving tool and mechanism of movement, 3. Organ integration and function as well the control system on individual. 4. Regulation and homeostatis, 5. Reproduction and growth.

**GOAL :**

Students can understand the structure and function of animal organ and explain work mechanism on *homeostatis* system on animal.

**TOPIC :**

Chemical and energy reaction on animal, integument system, bone system, muscular system, nerve system, endocrine system, cardiovascular system, spleen and immune system, respiration, ingestion, urine system, reproduction, nutrition, and metabolism.

**LEARNING STRATEGY :**

Class meeting (lecture), lab work, assignment, quiz, presentation and discussion, exams.

**REFERENCE :**

Seeley, R R, Stephens, T.D, Tate, P. 2006. *Anatomy and Physiology*. McGraw Hill, NY. Abbas, A.K dan A.H. Litchman. 2005. *Cellular and Molecular Immunology*. Elsevier Saunder. Philadelphia. Alberts, B, Johnson, A, Lewis, J, Matin, Roberts, K, Walter, P. 2002. *The Cell*. Garland Science, NY. Fox,S.I. 2004.

*Human Physiology*. 8 th. Ed. McGraw Hill Company. New York. ; Heiser,J.b.,Janis,C., dan Pough,F.H. 1999. *Vertebrate Life*. 5 th ed. Prentice Hall International Inc. London; Kardong,K.V. 2002. *Vertebrates. Comparative Anatomy. Function,Evolution*. McGraw Hill Company. New York.; Kent,G.C & Carr, R.K. 2001. Comparative Anatomy of the Vertebrates.. 9th ed. McGraw Hill Company. New York; Schmidt-Nielsen,K.1997. *Animal Physiology. Adaptation & environment*. 5 th. Cambridge University Press. Cambridge. New York. Post Chester. Melbourne. Sydney.; Seeley,R.R., Stephens,T.D, & Tate,P. 2003. *Anatomy and Physiology*. 6 th ed. McGraw Hill New York; Wheater,P.R., Burkitt,H.G. & Daniels,V.G. 1979. *Functional Histology*. Chuechill Livingstone Edinburgh. London.New York

**MOLECULAR BIOLOGY (MAB4162) 2 (2-0) credits**

**Prerequisite : MAB4261**

**BRIEF DESCRIPTION :**

This course describes the eukaryotic, protein synthesis (gene expression); transcription and translation process, controlling gene expression in molecular way for prokaryotic and eukaryotic. Mechanism of DNA replication and enzymes for: mechanism of homologous recombinant, and site-specific recombinant and transposition. Gene regulation mechanism: Reg. sequence in protein coding gene & cascade signaling pathway for controlling gene activity, basic structure of proteins: determination and classification, modification of protein and proteomic, protein turn-over Interaction of DNA-Protein & Protein-Protein in Eukaryotes and prokaryotes.

**GOAL :**

Students can explain and analyze the basic concept of molecular, gene expression synthesis and its regulation, analysis of genome, bioinformatics, and proteins.

**TOPIC :**

Chromosome structure, DNA, gene and RNA, DNA replication, protein synthesis/gene expression. Gene regulation, HBG and bioinformatics. Mechanism of DNA replication and enzymes for: mechanism of recombinant homologous and Site-specific recombination and transposition. Gene Regulation Mechanism: Reg. sequence in protein coding gene & cascade signaling pathway for controlling gene activity. Basic structure of Protein: determination and classification, modification of protein and proteomic. Interaction of DNA-Protein & Protein-Protein in Eukaryotes and prokaryote. Application of molecular Biology in terms of environment, microbe, animal, plant and biomedical science: DNA Fingerprinting, DNA Typing, Foot printing, and in Prokaryotes.

**LEARNING STRATEGY :**

Bio-molecular is presented in power point media and pdf, animation by using source: Animation Movie from MCB (molecular cell Biology, Lodish et al.) and Animation Movie from The Molecular

Biology of Cell, Albert et al.: Lecture and Video, etc. Lecturers give quiz and assignment, presentation, discussion and student centered learning (SCL).

**REFERENCE :**

Brown, T.A. *Genetics: A Molecular Approach*; Lewin, B. Genes; Stickberger, M.W. Genetics;Robyt, J.F. & White. *Biochemical Techniques* : Theory & Practice; Wilson, K. & Goulding. *Principles and Techniques of Practical Biochemistry*; Becker, J.M. et al. 1996. *Biotechnology. A Laboratory Course.* 2nd Ed.Academic Press. New York; Cooper, G.M. nd2004. *The Cell. A Molecular Approach*. 2 Ed. ASM Press. Sinauer Associates, Inc.; Glick, B.R. & Pasternak. 1998.

**BIOSTATISTICS (MAB4143) 3 (2-1) credits**

**Prerequisite : MAS 4180**

**BRIEF DESCRIPTION :**

This course explains the basic principles and kinds of experiment design, hypothesis test, test mode, experiment design. Analysis of correlation and regression (linier and non-linier) in Biology. Analysis of probit. Analysis of statistic non parametric. Process the data by using statistic program in PC.

**GOAL :**

Students are expected to be able to plan and analyze research data based on statistic analysis manually or in computer.

**TOPIC :**

Basic principles and kinds of experiment design, test mode, treatment design. Analysis of correlation and regression (linier and non-linier) in Biology. Analysis of probit. Analysis of statistic non parametric. Process the data by using statistic program in PC.

**LEARNING STATEGY :**

Class meeting, lab work, assignment, quiz, presentation and class discussion, exams.

**ANIMAL EMBRYOLOGY (MAB4138) 3 (2-1) credits**

**Prerequisite : MAB4137**

**BRIEF DESCRIPTION :**

This course describes the definition of embryo development principles of vertebrata animal. Making of gamete or gametogenesis that is spermatogenesis and oogenesis. Fertilization that covers

change on spermatozoa or ovum when fertilization happens and when it is over. In this subject, there is also explanation about kinds of cleavage in vertebrata and the process of gastrulation. Differentiation on every layer of embryo that consist of ectoderm, mesoderm and endoderm differentiation. Abnormality that might happen while the process of gametogenesis and organogenesis runs.

**GOAL :**

Students can explain and analyze steps of embryo development and processes of embryo development and its regulation.

**TOPIC :**

Development principles, gametogenesis, fertilization, cleavage, gastrulation, ectoderm differentiation, mesoderm and endoderm, metamorphosis and teratology.

**LEARNING STRATEGY :**

Class meeting (lecture), lab work, assignment, quiz, and examinations.

**REFERENCES :**

Bard, J. 1992, *Morphogenesis*. 1 st ed. Cambridge University Press. Cambridge. Carlson,B.M. 1999. *Human Embriology and Devalopmental Biology*, 2 nd ed. Mosby. St Louis. London. Philadelphia. Sydney. Toronto. Gilbert,S.E. 2000. *Developmental Biology*. 3 th ed. Sinauer Asssocates Inc. Publisher. Sinauer. Massachusetts.

**ENTERPRENEURSHIP (UBU4005) 3 (2-1) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course covers the entrepreneurship character, personality that must be owned by a businessman; leadership and soft skill, how to take a risk, to make decision, entrepreneurship in Biology, business plan and analysis of economy.

**GOAL :**

Students can understand entrepreneurship principles and management. They are expected to know how to plan and stimulate business. They will be motivated to develop entrepreneurship inside their soul.

**TOPIC :**

Entrepreneurship character, behavior that must be owned by a businessman; leadership and soft skill, how to take a risk, to make decision, entrepreneurship in Biology, business plan and analysis of economy, writing proposal business, practice and product test.

**LEARNING STRATEGY :**

General lecture, problem based learning, presentation, discussion, work visit, business proposal presentation, practice, business simulation, examinations, and assignments.

**REFERENCE :**

Meredith, G.G., Nelson R. E., & Neck P.A. 1995. *Kewirausahan: Teori dan Praktik*. Penerjemah Andec Asparsayogi. *Lembaga PPM bekerja sama dengan PT. Pustaka Binaman Pressindo*. Jakarta. Zimmerer T.W. Scarborough N.M. 2002. *Pengantar Kewirausahaan dan Manajemen Bisnis Kecil*. Penerjemah Yanto Sidik Puatiknyo & Edina Tjahyaningsih Tarmidzi. Prenhallindo. Jakarta. Lambing P.A. & Kuehl C.R. 2003. *Entrepreneurship*. Third Edition. Prentice Hall. New Jersey. Soemanto, W. 1993. *Sekuncup Ide Operasional Pendidikan Wiraswasta*. Bumi Aksara. Jakarta. Morris M.J. 1996. Kiat *Sukses pengembangkan Usaha Kecil*. Penerjemah Gatot Saksono. Penerbit Arcan. Jakarta. Hisrisck R.D., Refers M.P. 2002. *Entrepreneurship*. International Edition. McGraw Hill Higher Education. Singapore. Suryana. *Kewirausahaan.* Salemba Empat, Jakarta, 2001. Sarbana Baban. *Great Spirit for Success*. Elex Media Computindo, Jakarta, 2003.

**ENGLISH LANGUAGE (UBU4004) 3 (3-0) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

Students can read English scientific books, communicate in English either oral or written, use good structure and utterance.

**GOAL :**

Students are able to explain technique of reading scientific texts and communicate fluently and use good structure and utterance.

**TOPIC :**

Writing comprehensive, Listening comprehensive, Reading comprehensive (finding main topic in oral and written), Grammar and structure (sentence structure is taught based on scientific text General Biology) and Oral presentation technique (in Biological field).

**LEARNING STRATEGY :**

Study, lab work, quiz, assignments, presentation, discussion and student centered learning (SCL)

**INDONESIA LANGUAGE (UBU4008) 3 (3-0) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course covers the Indonesia language usage in understanding scientific book, especially Biology, vocabulary and utterance improvement and grammar usage in scientific texts.

**GOAL :**

Students are able to use Indonesia language well and have more vocabularies that can be written for wring scientific work and discussion.

**TOPIC :**

Indonesia language usage in understanding scientific book, especially Biology, vocabulary and utterance improvement and grammar usage in scientific texts.

**LEARNING STRATEGY :**

Lecture, lab work, quiz, assignment, presentation, discussion, and student centered learning (SCL).

**FIELD WORK PRACTICE (INTERNSHIP) (UBU4009) 2 (0-2) credits**

**Prerequisite : ≥90 credits**

**BRIEF DESCRIPTION :**

Internship is an activity conducted by students in a government or private institution.

**GOAL :**

Students can get new experiences to work in Biology field.

**TOPIC :**

internship in government or private institutions. Biology research that contributes to applied sciences in research places and two supervisors will guide the students. After internship, students are supposed to make a poster and written report for exam.

**LEARNING STRATEGY:**

Students work at an institution for min 102 hours. This agenda covers guide in first semester, work, drawing poster and written report. Monitoring and evaluation conducted by two supervisors, examiner and coordinator.

**PARCITIPATORY COMMUNITY DEVELOPMENT (UBU4002) 3 (0-3) credits**

**Prerequisite : 108 credits**

**BRIEF DESCRIPTION :**

This course covers the definition of bio-conservation and its application, Explanation about plan concept of environmental problems and application of the concept in the village of conservation, evaluation of results, making decision of future plan for the problem in that area.

**GOAL :**

Students can explain Biology contribution to natural resource conservation and understand Biology problems then they can apply their knowledge to solve the problems.

**TOPIC :**

Definition of bio-conservation, bio-conservation application, writing concept of planning to solve environmental problems, good behavior to people, socio-ecology in the target village such Ranupani, national park, and Porang park (Bendo village, Madiun city), evaluation of results, and decide plans of future to solve problems in the area.

**LEARNING STRATEGY :**

Guideline, speech, general lecture from national park officials and village leaders, discussion, practice and integrated entrepreneurship learning.

**REFERENCE :**

Based on the problems happen in the target area

**RESEARCH PROPOSAL SEMINAR (MAB4005) 1 (0-1) credits**

**BRIEF DESCRIPTION : ≥ 108 SKS, students have to determined a supervisor**

This subject is taken by students who have written or have been writing research proposal. Then, they present it in front of students, supervisor and examiner. Students should participate in the seminar to develop scientific presentation skill.

**GOAL :**

Students are able to apply methods of scientific presentation or research well. After seminar, students revise their proposal and start to write thesis research.

**TOPIC :**

Study the literatures related to thesis, presentation of thesis proposal orally in front of students, supervisor, or examiner and some topics of research seminar that are taken by students who program thesis proposal seminar.

**LEARNING STRATEGY :**

Intensive discussion with supervisor, attending research proposal seminar, presenting research design in the seminar managed by Biology. Evaluation for this subject is determined based on the quality of draft and revision, proposal text, way of presentation and argumentation.

**REFERENCE :**

Jurusan Biologi, 2000. *Pedoman Penulisan Skripsi. Jurusan Biologi, FMIPA*, Universitas Brawijaya, Malang; Fakultas MIPA. *Pedoman Penulisan Tugas Akhir*. FMIPA. Universitas Brawijaya.

**RESEARCH PROGRESS SEMINAR (MAB4006) 1 (0-1) credits**

**Prerequisite : MAB4005**

**BRIEF DESCRIPTION :**

This course describes the writing report of research progress on the final project/thesis and students present it.

**GOAL :**

Students are expected to monitor the research and data analysis, they are able to apply presentation way in scientific forum and present the research well in front of examiner, supervisor and students.

**TOPIC :**

Data analysis and research finding interpretation, presentation of research progress and writing research report on a thesis.

**LEARNING STRATEGY :**

Intensive discussion with supervisor and presentation of research progress in the seminar.

**REFERENCE :**

Jurusan Biologi, 2000. *Pedoman Penulisan Skripsi*. Jurusan Biologi, FMIPA, Universitas Brawijaya, Malang.

**FINAL PROJECT/THESIS (UBU4001) 6 (0-6) credits**

**Prerequisite : MAB4005**

**BRIEF DESCRIPTION :**

This course describes the methods to conduct research based on proposal, to analyze data and to interpret the research progress and write research report on the thesis and maintain it in the research exam.

**GOAL :**

Students are able to prepare and conduct research, interpret and write it in written text and present it, have comprehension about Biology concept, mostly related to their research.

**TOPIC :**

Conducting research according to proposal, analyzing data and interpreting the finding, presenting and writing it down on a thesis and defend their research in exam.

**LEARNING STRATEGY :**

Discussion with supervisor, lab work or internship according to topic, report, thesis exam, evaluation based on proposal seminar (10%), research finding seminar (20%) and thesis exam (70%).

**REFERENCE :**

Jurusan Biologi, 2000. *Pedoman Penulisan Skripsi*. Jurusan Biologi, FMIPA, Universitas Brawijaya, Malang.

**RESEARCH METHOD OF BIOLOGY RESEARCH AND SCIENTIFIC WRITING 2 2 (2-0) credits (MAB4270)**

**Prerequisite** **: MAB4101**

**BRIEF DESCRIPTION** **:**

This course covers the essence of science, Biology research methods and scientific writing procedures.

**GOAL** **:**

After taking this subject, students are expected to be able to explain the essence of science, to choose the research method and to apply it in the scientific work.

**TOPIC** **:**

Introduction: essence of science, ontology, epistemology, science method, syllogism, deductive, empiric, and inductive. Science development, system of science, research problems, science problems, examination for interpretation, technology and science. Some basic methods, kinds and designs of research. Experimental and observational research design. Research process. Data process: descriptive, picture, graphic, statistic analysis. Hypothesis test based on the parametric data and non-parametric of data interpretation. Language style in scientific writing and popular science.

**LEARNING STRATEGY** **:**

Subjects of Biology research method and scientific writing will be delivered by power point in LCD. Assignments are given in the class to train how to write scientific works and Biology research method. To evaluate students achievement, lecturers give quiz and exams.

**REFERENCE** **:**

Hoover, H. 1970. *Essentials for the Scientific and Technical Writer*. Dover Publ. New York; Howard, K and J.A. Sharp. 1983. *The Management of a Student Research Project.* Gower Publ. Cambridge.; Marzano, R.J. et al. 1988. *Dimensions of Thinking: a framework for curriculum and instruction.* ASCD, Virginia.; Matiru, B. et al. 1995. *Teach Your Best: A Handbook for University Lecturer.* ISOS-GhK. Germany.; Nazir, M. 1988. *Metode Penelitian.* Ghalia Indonesia, Jakarta.; Suriasumantri, J.S. 1981. *Ilmu dalam Perspektif.* Gramedia. Jakarta.

**PLANT SYSTEMATICS (MAB4213)** **3 (3-0) credits**

**Prerequisite** **: -**

**BRIEF DESCRIPTION** **:**

This course has three credits for class meeting and two credits for lab work. It covers the concept of plant systematic, understanding the distinction characteristics of plant class and understanding the plants in every class.

**GOAL :**

Students are expected to be able to understand and apply principles of plant systematic and its growth, good at applying principles of plant systematic (to describe, identify, classify plants, nomenclature and analyze plant genetic), to understand the distinction of characteristics among taxonomy/plant group: among kingdoms to species, to present and discuss ideas/suggestion related to plant systematic, in oral or written form.

**TOPIC :**

Subjects given cover two aspects, the subject (1) to discuss principles of plant taxonomy, such as concept and contribution of taxonomy for Biology, ability to describe, identify, classify plants and nomenclature. Explanation of plant classification system through phylogenetic and phenetic (2) to cover part of plant introduction that collaborate Engler classification system and Prantl and Five Kingdom that are Thallophyta, Bryophyta, Pteridophyta and Spermatophyta. Project or assignment focuses on the learning that train skill in applying taxonomy principles and problem solving about plant systematic.

**LEARNING STRATEGY :**

Student centered learning (SCL), speech, presentation, discussion, integrated English learning, integrated entrepreneurship learning, and field study, evaluation in quiz, assignment, exam, presentation and discussion.

**REFERENCE :**

Margulis, L. and Schwartz, K.V. 1998. *Five Kingdoms, an Illustrated Guide to the Phyla of Life on Earth.* 3rd edition. A.W.H. Freeman/Owl Book. New York. Michael G. Simpson. 2006. *Plant Systematics*. Elsevier. Amsterdam. Radford, A.E. 1986. *Fundamentals of Plant Systematics*. Harper & Row Publisher. NY; Singh, G. 2003. *Plant Systematics: An Integrated Approach*. Science Publishers. London; Stace, C.A. 1979. *Plant Taxonomy and Biosystematics*. Edward Arnold a Division Holder a Stoughton. London; Tjitrosoepomo, G. 2005. *Taksonomi Tumbuhan: Spermatophyta*. Gajah Mada University Press. Yogyakarta. Tjitrosoepomo, G. 2005. *Taksonomi Tumbuhan*: Schizophyta, Thallophyta, Bryophyta, Pteridophyta. Gajah Mada University Press. Yogyakarta. Vogel, E.V. 1987. *Manual of Herbarium Taxonomy: Theory and Practice*. Rijkherbarium. Leiden.

**LAB WORK OF PLANT SYSTEMATICS (MAB4214) 2 (0-2) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This activity gives the skill guide and understanding about plant diversity by conducting lab work in the laboratory and native habitat.

**GOAL :**

Students are expected to be able to know, describe, identify, and classify sample of organism categorized in algae micro and macroscopic, fungus, moss, and seed plants.

**TOPIC :**

Technique of drawing plant, microalgae, macroalgae, fungi and moss, Gymnospermae, Dicotile and Monocotile.

**LEARNING STRATEGY :**

Lab work, experiment in field area, Purwodadi park, Brantas River and other areas.

**REFERENCE :**

Backer, C.A. and Van Den Brink, R.C. 1965. *Flora of Java.* Wolters-Noordhoff N.V.- Groningen, The Netherlands. *Series of Flora Malesiana.* 1976-recent. Etc .

**ANIMAL SYSTEMATICS (MAB4271) 3 (3-0) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course describes the basic knowledge and definition of animal systematic (Protozoa to Chordata) by discussing the animal evolution, genetic relation in phylogenetic, classification of invertebrate and vertebrate, studying general and specific characteristics in classification of invertebrate and vertebrate.

**GOAL :**

Students are expected to be able to classify invertebrate and vertebrate, to understand the basic classification, to describe and explain general and specific characteristic that are basic identification of vertebrate and invertebrate animal, and to explain genetic relation among animal groups.

**TOPIC :**

Introduction to animal systematic, Indonesia fauna taxonomy, position and classification of protozoa, classification and characteristics of Cnidaria, classification and characteristic of Plathyhelminthes, Nematoda, Annelid, mollusca, Arthopoda, Insect, Deuterosmia, Condroichthyes, Osteichtyes, Amphibian, Reptile, Aves, mammals, zoogeography, Lecture in English: modern systematic, business potency of invertebrate and vertebrate.

**LEARNING STRATEGY :**

Student centered learning (SCL), speech, presentation, discussion, integrated English learning, integrated entrepreneurship learning, and field work, evaluation through: quiz, assignment, presentation, discussion and exams.

**REFERENCE :**

Barnes, R. 2001. *The Invertebrates*. Blackwell Science. Colbert, E.H.,1991, *Evolution of the Vertebrata*. John Willey and Sons, New York.; Borror, T.J..1992. *Pengenalan Pelajaran Serangga.* Penerbit UGM Press. Yogyakarta. Jamieson,B.,G.M.1991. *Fish Evolution and systematics,* Cambridge University Press.; MacKinnon J. 1999. *Seri Paduan Lapangan Burung-Burung di Sumatera, Jawa dan Bali*.; Linzey D. 2000. *Biology Vertebrate*, McGraw Hill. Kardong, K.V. 2002. *Vertebrates. Comparative Anatomy*, th Function, Evolution. McGraw Hill. Pechenik, J.A. 2000. Biology of the Invertebrate. 4 ed. McGraw Hill. Boston. Pedigo, L. 1999. *Entomologi and Pest Management*. Prentice Hall. Vaughan, 1986. Mammalogy, Saunders College Publishing, Philadelpia.; Webb, J.E. 1995. *Guide to Invertebrates Animals*. Zug, R.G.1993, *Herpetology, An Introductory Biology of Amphians and Reptilia*, Academic Press, San Diego.

**PRACTICE OF ANIMAL SYSTEMATICS (MAB4275) 2 (0-2) Credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This practice gives basic skill in describing, identifying, classifying, and determining taxon in animal classification system (protozoa to Chordata) through training about: classification of invertebrate and vertebrate, study general and specific characteristics in classification of invertebrate and vertebrate.

**GOAL :**

Students can describe, draw and take picture, identify, classify and determine taxon of invertebrate and vertebrate based on the general and specific characteristics in laboratory and field, understand the basic classification and aware to animal conservation.

**TOPIC :**

Position and classification of protozoa, classification and characteristics or Porifera, position and classification of Cnidaria, Platyhelminthes, Nematoda, and characteristics of Annelida), classification and characteristics of Molusca, Arthropoda, Insect, Condroichthyes, Osteichthyes, Amphibia, Reptilia, Aves, Mammals, genetics relation and field practice.

**LEARNING STRATEGY :**

Student centered learning (SCL), survey, lecture assistant, practice, lab work, evaluation: report, exams.

**REFERENCE :**

Barnes, R. 2001. *The Invertebrates*. Blackwell Science. Colbert,E.H.,1991, *Evolution of the Vertebrata*. John Willey and Sons, New York.; Borror, T.J..1992. *Pengenalan Pelajaran Serangga.* Penerbit UGM Press. Yogyakarta. Jamieson,B.,G.M.1991. *Fish Evolution and systematics*, Cambridge University Press.; MacKinnon J. 1999. *Seri Paduan Lapangan Burung-Burung di Sumatera, Jawa dan Bali*.; Linzey D. 2000. *Biology Vertebrate*, McGraw Hill. Kardong, K.V. 2002. *Vertebrates. Comparative Anatomy, The Function, Evolution*. McGraw Hill. Pechenik, J.A. 2000. Biology of the Invertebrate. 4 ed. McGraw Hill. Boston. Pedigo, L. 1999. *Entomologi and Pest Management*. Prentice Hall. Vaughan, 1986. Mammalogy, Saunders College Publishing, Philadelpia.; Webb, J.E. 1995. *Guide to Invertebrates Animals*. Zug,R.G.1993, *Herpetology, An Introductory Biology of Amphians and Reptilia*, Academic Prees, San Diego.

**PLANT STRUCTURE AND GROWTH (MAB4216) 3 (3-0) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course describes the outer part organ of vegetative and reproduction of plant in macroscopic and structure, function and growth of vegetative organs and reproduction of seed plant in microscopic.

**GOAL :**

Students are able to explain structure, function and growth of vegetative organs and reproduction in macro/micro of seed plants, to apply and collaborate knowledge about structure, function and growth of plant and reproduction in macro/micro of seed plants with phenomena happening in universe, to describe micro/macro characteristics of structure, function and growth of vegetative organs and reproduction of seed plants.

**TOPIC :**

Introduction, structure of vegetative outer part organ of plant, reproduction of seed plant, modification of organ discussed is about plant function and architecture. Structure, function and growth of vegetative organ of plant in microscopic: cell structure, cell rilem bane and protoplast; merysteme tissue, protector tissue, basic tissue, supportive tissue, secretion, cambium, root, stem, and leaves, transition area, primary and secondary growth, structure and growth of reproduction organ of seed plat in micro way: flower, sporogenesys, pollination, gametogenesys, fertilization, and embryogenesis of

seed plant; fruit and seed, polyembryoni, apomixis, sexual incompatibility, germination and metagenesis.

**LEARNING STRATEGY :**

Class meeting, quiz, assignments, presentation and discussion and student centered learning (SCL).

**MAIN REFERENCE :**

Cutler, D.F., T. Botha & D.W. Stevenson. 2007. *Plant Anatomy: An Applied Approach.* Blackwell Publishing.; Rudall, P.J. 2007. *Anatomy of Flowering Plants: An Introduction to Structure and Development*. Cambridge University Press.; Evert, R.F. 2006. *Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body-Their Structure, Function, and Development.* Third Edition. A John Wiley & Sons, Inc. Publication. New Jersey.; Harris, J.G. & M.W. Harris. 2001. *Plant Identification Terminology: An Illustrated Glossary*. Second Edition. Spring Lake Publishing. Spring Lake Utah.; Dickison, W.C. 2000. *Integrative Plant Anatomy.* Harcourt Academic Press. San Diego.; Bowes, B.G. 1995. *A Colour Atlas of Plant Structure*. Manson Publishing.; Bell, A.D. 1991. *Plant Form: An Illustration Guide to Flowering Plant Morphology*. Oxford University Press. New York.; Essau, K. 1987. *Anatomy of Seed Plants. Second Edition. John Wiley & Sons*. New York.; Fahn, A. 1974. *Plant Anatomy*. Second Edition. Pergamon Press. Oxford.; Bhojwani, S.S. & S.P. Bhatnagar. 1974. The Embryology of Angiosperm. Vikas Publ. House PVT. Ltd. New Delhi.; Lawrence, G.H.M. 1964. *Taxonomy of Vascular Plant*. The McMillan Company. New York.

**OTHER REFERENCES :**

Nugroho, L.H., Purnomo, I. Sumardi. 2010. *Struktur dan Perkembangan Tumbuhan.* Penebar Swadaya. Jakarta.; Hidayat, E.B. 1995. *Anatomi Tumbuhan Berbiji*. Penerbit ITB. Bandung.; Tjitrosoepomo, G. 1990. *Morfologi Tumbuhan*. Gadjah Mada University Press. Yogyakarta.

## PRACTICE OF PLANT STRUCTURE AND GROWTH (MAB4216) 2 (0-2) SKS

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course describes the outer part organ of vegetative and reproduction of plant through macroscopic and structure, function and growth of vegetative organs and reproduction of seed plant through microscopic.

**GOAL :**

Students are able to explain structure, function and growth of vegetative organs and reproduction in macro/micro of seed plants, to apply and collaborate knowledge about structure,

function and growth of plant and reproduction in macro/micro of seed plants with phenomena happening in universe, to describe micro/macro characteristics of structure, function and growth of vegetative organs and reproduction of seed plants.

**TOPIC :**

Outer part structure of vegetative organ: root, stem, and leave. The arrangement of leave on stem and branch architecture. Outer part reproductive structure of plants: flower, flower terms, flower structure, flower, fruit, seed, and embryo diagram. The structure and development of vegetative organ on plants in microscopis: cell, protoplasmic and non-protoplasmic component, cell rilem bane, meristem tissue, protective tissue, basic tissue, supportive tissue, transport tissue, secretion tissue, vascular cambium, cork cambium; root, stem and leave. Structure and development of reproductive organ in microscopic: sepala, petala, andresium, ginesium, and embryogenesis on seed plant. Germination.

**LEARNING STRATEGY :**

Laboratory and field work and student centered learning (SCL).

**MAIN REFERENCE :**

Cutler, D.F., T. Botha & D.W. Stevenson. 2007. *Plant Anatomy: An Applied Approach.* Blackwell Publishing.; Rudall, P.J. 2007. *Anatomy of Flowering Plants: An Introduction to Structure and Development*. Cambridge University Press.; Evert, R.F. 2006. *Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body-Their Structure, Function, and Development.* Third Edition. A John Wiley & Sons, Inc. Publication. New Jersey.; Harris, J.G. & M.W. Harris. 2001. *Plant Identification Terminology: An Illustrated Glossary*. Second Edition. Spring Lake Publishing. Spring Lake Utah.; Dickison, W.C. 2000. *Integrative Plant Anatomy.* Harcourt Academic Press. San Diego.; Bowes, B.G. 1995. *A Colour Atlas of Plant Structure*. Manson Publishing.; Bell, A.D. 1991. *Plant Form: An Illustration Guide to Flowering Plant Morphology*. Oxford University Press. New York.; Essau, K. 1987. *Anatomy of Seed Plants. Second Edition. John Wiley & Sons*. New York.; Fahn, A. 1974. *Plant Anatomy*. Second Edition. Pergamon Press. Oxford.; Bhojwani, S.S. & S.P. Bhatnagar. 1974. The Embryology of Angiosperm. Vikas Publ. House PVT. Ltd. New Delhi.; Lawrence, G.H.M. 1964. *Taxonomy of Vascular Plant*. The McMillan Company. New York.

**OTHER REFERENCES :**

Nugroho, L.H., Purnomo, I. Sumardi. 2010. *Struktur dan Perkembangan Tumbuhan.* Penebar Swadaya. Jakarta.; Hidayat, E.B. 1995. *Anatomi Tumbuhan Berbiji*. Penerbit ITB. Bandung.; Tjitrosoepomo, G. 1990. *Morfologi Tumbuhan*. Gadjah Mada University Press. Yogyakarta.

**ANIMAL HYSTOLOGY (MAB4231) 2 (1-1) credits**

**Prerequisite** : -

**BRIEF DESCRIPTION** :

This course covers the characteristics of basic tissue such as epithele, bond tissue, muscle tissue, and nervous tissue. Structure and function of organ systems such as integument system and the derivate, skeletal system, digestive system, respiratory system, blood and valve circulatory system, excretion, reproduction, nerves, sense organ and endocrine system.

**GOAL** :

Students are able to differentiate kinds and components of tissue and analyze histology microscopic slide.

**TOPIC** :

Animal cell, basic tissue, epitel tissue, bond tissue, muscle tissue, and nervous tissue. Structure and function of organ systems such as integument system and the derivate, skeletal system, digestive system, respiratory system, blood and valve circulatory system, excretion, reproduction, nerves, sense organ and endocrine system.

**LEARNING STRATEGY** :

Class meeting, lab work, assignments, quiz, presentation discussion and exams.

**REFERENCE** :

Fox,S.I. 2004. *Human Physiology.* 8th. Ed. McGraw Hill Company. New York; Heiser,J.b.,Janis,C., dan Pough,F.H. 1999. *Vertebrate Life*. 5th ed. Prentice Hall International Inc. London; Kardong,K.V. 2002. *Vertebrates. Comparative Anatomy*. Function,Evolution. McGraw Hill Company. New York.; Kent,G.C & Carr, R.K. 2001. *Comparative Anatomy of the Vertebrates*. 9th ed. McGraw Hill Company. New York; Schmidt-Nielsen, K.1997. *Animal Physiology. Adaptation & environment*. 5 th. Cambridge University Press. Cambridge. New York. Post Chester. Melbourne. Sydney.; Seeley,R.R., Stephens,T.D, & Tate,P. 2003. *Anatomy and Physiology*. 6 th ed. McGraw Hill New York; Wheater,P.R., Burkitt,H.G. & Daniels,V.G. 1979. *Functional Histology*. Chuechill Livingstone Edinburgh. London .New York.

**BIOCHEMISTRY AND INTRUMENTATION** **3 (2-1) credits**

**Prerequisite** : -

**BRIEF DESCRIPTION** :

**GOAL** :

Students can explain and analyze physical and chemical characteristic of biomolecular compound and the metabolism, mechanism of enzymes, kinetic and factors influencing enzyme activity, instrumentation is focused on the usage and maintenance of lab equipments.

**TOPIC :**

(1) Introduction: biochemistry among other sciences (physiology, nutrition, medical, agriculture, evolution and ecology); general characteristics and compounds constituent creature or bio-molecular.
(2) Proteins: amino acid and peptide, protein metabolism of creature, assay method.
(3) Carbohydrate: classification and metabolism, assay method.
(4) Lipid: classification and metabolism, assay method.
(5) Enzyme: work mechanism, factors influencing enzyme activity, regulation in Biology system.
(6) Vitamin and mineral: metabolism within cell
(7) Bio-synthesis: carbohydrate, lipid, amino acid, and nucleotide.
(8) Usage and maintenance of research equipments in the laboratory (calibration pH, pH meter, specto-photometry, centrifuge, analytical balance and micropipette)

**LEARNING STRATEGY :**

Student centered learning (SCL), speech, presentation, discussion, integrated English learning and lab work, evaluation; quiz, exam, presentation, discussion, and report.

**REFERENCE :**

Thenawijaya, M., 1982, *Dasar-dasar Biokimia*, Penerbit Erlangga; Mc Kee, T. and Mc rd Kee J.R., 2003, *Biochemistry: The Molecular Basis of Life*, 3 ed., McGraw Hill

**PLANT PHYSIOLOGY (MAB4220) 4 (3-1) credits**

**Prerequisite : MAB4216, MAB4160, MAB4241**

**BRIEF DESCRIPTION :**

This course describes the relation among structure, process, and function of plants.

**GOAL :**

Students are able to explain how plants use sun energy to assimilate carbon, to get energy, to respond to environment, to get and to distribute nutrient and water, to react to stress, to grow and to develop. They can analyze plant performance in the field area based on its physiology condition.

**TOPIC :**

Definition and scope of plant physiology, water and plant cell, transportation of nutrient and water, transpiration, photosynthesis, translocation within floem, respiration, metabolism of nitrogen and lipid, mineral nutrient assimilation, secondary metabolite and plant resistance. Types and roles of

hormone in plant growth and development, plant moving mechanism, phytochrome, and light control in plant development, secretion control: photoperiodism and vernalization, and stress physiology.

**LEARNING STRATEGY :**

Class meeting, lab work, assignment, presentation and discussion. The subjects of Plant Physiology are presented by using Microsoft power point, LCD and handout. Assignments are given to improve student knowledge of plant physiology. Lab works for certain topics are given to make students understand more about Plant Physiology. To evaluate student comprehension, lecturers give quiz, assignment and exams.

**REFERENCE :**

Taiz L.and E. Zeiger. 2002. *Plant Physiology*. Sinauer Associates, I nc. Publishers. Sunderland, Massachusetts. Pessarakli, M. 2001. *Handbook of Plant and Crop Physiology.* Marcel Dekker,Inc. NewYork Opik, H. and S. Rolfe. 2005 *The Physiology of Flowering Plants*. Cambridge University Press. Cambridge, New York. Pallardy, S.G. 2008. *Physiology of woody plants.* Elsevier Inc, New York. Jenks, M.A.and P.M. Hasegawa. 2005. *Plant Abiotic Stress.* Blackwell Publishing Ltd.

**BIODIVERSITY CONSERVATION (MAB4276) 6 (4-2) credits**

**Prerequisite : MAB4173**

**BRIEF DESCRIPTION :**

This course covers the new paradigm of biodiversity conservation and analysis technique of biodiversity such as: analysis of species diversity through qualitative and quantitative (indirect, census, and sampling) and biodiversity mapping. It also describes Genetic diversity in molecular level, impact of man's activity, conservation strategy and international organization role.

**GOAL :**

Students are able to explain and analyze the biodiversity component, quality, value, role, mapping and extinction. Students can do some diversity analysis techniques (species and ecosystem) and its mapping. They are also expected to be able to explain the biodiversity extinction, ecology role, population and genetics dynamics to analyze the cause of extinction and find the solution of in situ or ex situ. They will get skills of environmental analysis to plan natural resource conservation.

**TOPIC :**

Two paradigms of Biology conservation, threat of species diversity extinction: ancient era and today's cases, activity of human and extinction rate, regulation and agreement of national/international to species extinction, conservation status, risks faced by small population, analysis of species viability and variability, population dynamics, conservation strategies: maintaining ecosystem diversity that

supports life, conserving genetic diversity, and guaranteeing biodiversity utilization through in situ and ex situ. Bio-prospect, economy, trade and policy of biodiversity conservation. environmental analysis and plan of environmental conservation program that focuses on work quality. International organization role in biodiversity conservation.

Biodiversity Limitation, value, quality, role and extinction. Biodiversity analysis technique: analysis of species diversity in qualitative and quantitative method (indirect, census, and sampling) and mapping biodiversity. Analysis technique of structure analysis, classification and diversity of animal, plant and microorganism. Identification of genetic diversity in molecular level, application and biotechnology impact to biodiversity, impact of human activity to biodiversity, biodiversity conservation strategy, and biodiversity and culture.

**LEARNING STRATEGY :**

Class meeting, lab work, quiz, assignments, presentation and class discussion, student centered learning (SCL), Integrating English learning and Collaborative learning, field practice, guest lecture and case study. Evaluation: assignments, quiz, exams, presentation and discussion.

**REFERENCE :**

Kumar, H.D.1999. *Biodiversity and Sustainable Conservation*. Science Publ. Inc., New Hampshire. Caughley, G. and A. Gunn, 1996. *Conservation Biology in Theory and Practice*, Blackwell Science. Oxford; Dobson, A. 2000. *Biodiversity and the future of democracy*. Tree. 12 (1): 39-40.

**GENETICS (MAB4261) 4 (3-1) credits**

**Prerequisite : MAB4241**

**BRIEF DESCRIPTION :**

This course explains the topics and basics of heredity, chromosome and genetic material, change of heredity material and its influence to gene expression, heredity and balance of genetic and population.

**GOAL :**

Students are able to explain and analyze material and basic of heredity, change of heredity material and its impact to gene expression, heredity, and genetic balance in population.

**TOPIC :**

Meiosis and its relation with heredity. Mendelism: mono-, di-, trihybrid, domination, intermediate, co-dominant, reciprocal, back-cross, test-cross, interaction among genes, letality, polygene, double alel, probability theory and chi square test, sex determination: hetero and homogametic, sex bunch, gene mapping, chromosome, and genetic material, structure and organization

of DNA inside chromosome, replication and recombination, transcription, translation, genetic code and proteins, change of gene structure: recombinant, gene, mutation, cause and mutation mechanism, error of heredity in chromosome level: recessive autosomal, dominant, X-linked heredity, population balance, gene frequency, factors influencing gene frequency, and inbreeding.

**LEARNING STRATEGY :**

Class meeting, practice, problem task, quiz, assignments, presentation, discussion and student centered learning (SCL)

**REFERENCE :**

Strickberger, M.W. 1985. *Genetics*. Macmillan Pub. Co. New York.; Lewin. B. 1994. Genes V. John Wiley and Sons, New York.; Surya. 1991. *Genetika Manusia.* Gadjah Mada University Press. Yogyakarta. Clark, DP. 2005. *Molecular Biology. Understanding the genetic revolution.* Elsevier Academic Press. London

**GENERAL MICROBIOLOGY (MAB4250) 4 (2-2) credits**

**Prerequisite : MAB 4140 and MAK 4239**

**BRIEF DESCRIPTION :**

This course is arranged in 4 credits (2 credits for theory and 2 credits for practice) and the prerequisite if students have taken general Biology (MAB 4140), biochemistry and instrumentation (MAK 4239). Microorganism is spread around the world and has important role in environment and ecosystem. To understand microbe's role in life and other organisms in the ecosystem, we have to know microbe biodiversity and metabolism, genetics and its growth so we can develop it for human welfare and environmental conservation.

**GOAL :**

Students are able to explain microbial biodiversity and characteristics, its role for human life, its classification system, metabolism principles and microbial cell multiplication, exchange of microbial genetic material and microbial application in many fields.

**TOPIC:**

Scope and history of Microbiology, introduction to microbial diversity and its role for organism, structure and function of microbial cell of prokaryotic and eukaryotic, nutrition and its transportation of membrane trans, microbial metabolism and growth, microbial genetics, microbial engineering/biotechnology, species concept, microbial evolution and systematic and its application.

**LEARNING STRATEGY :**

Class meeting, discussion, lab work, presentation of assignment from English research journal related to subject and presentation of lab work report.

REFERENCE:

The Black, J. G. 2005. *Microbiology*: *Principles and Explorations*. 6th ed. John Wiley & Sons, th Inc.; Brock, T. D. & M. T. Madigan. 1998. *Biology of Microorganism.* 5th ed. Prentice Hall. Cliffs.; Lengeler, J. W. G. Drews, & H. G. Schlegel. 1999. *Biology of Prokaryotes*. George Thieme Verlag, Stuttgart-Germany.; Prescott, L. M., J. P. Harley, & D. A. Klein. Th 2003. *Microbiology*. 5th ed. Mc. Graw Hill Inc., New York.; Talaro, K. P. 2005. *Foundations in Microbiology*. 5th ed. McGraw-Hill Higher Education, New York.; th Tortora, G. J., B. R. Funke, & C. L. Case. 2010. *Microbiology: An Introduction*. 10th ed. Benjamin Cummings Inc., San Francisco.; Wheelis, M. C. 2008. *Principles of Modern Microbiology*. Jones and Bartett Publ., Inc., Ontario, Canada.

**EVOLUTION (MAB4203) 2 (2-0) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course explains the definition of evolution, evolution theories and its development.

**GOAL :**

Students are able to explain and give example of basic concept and development of evolution theory, correlation between diversity-universe selection-adaptation-speciation, genetic variation as evolution basic material. They can get comprehensive view of life change and use it to build definition and understanding of life.

**TOPIC :**

This course covers the beginning of concept and evidence of evolution, species diversity and natural support leading to life change, evolution mechanism based on the natural selection and correlation between life and creation of new species (Darwinian theory). Genetic variability and polymorphism in evolution cellular and molecular level. It describes the examples of plant and animal evolution in population scale (species, genus, family and order) and individual. Biogeography related to evaluation in Indonesia. Relevance and application of evolution mechanism in the development of culture and science-technology.

**LEARNING STRATEGY :**

Paper and power point materials, practice of mtDNA sequence analysis to understand the genetic relationship within evolution, workshop of technology for genetic concept in classic taxonomy.

Evaluation is given through quiz, exams. Other learning methods are student centered learning, collaborative learning and problem solving.

**REFERENCE :**

Bendall, D.S., 1983, *Evolution from Molecules to Men*, Cambridge Univ. Press, Cambridge; Futuyma, D.D., 1981, *Evolutionary Biology*, Sinauer Pub., Sunderland, Mass; Lewontin, R.C., 1974, *The Genetic Basis of Evolutionary Change*, Colombia Univ. Press. New York

**CITIZENSHIP (UNG 4007) 3 (3-0) credits**

**Prerequisite : >54 credits**

**BRIEF DESCRIPTION :**

**GOAL :**

Students are expected to be able to understand and apply knowledge about Indonesia, national defense, national policy and strategy, especially national defense and security, citizen security system to strengthen the national security.

TOPIC:

Definition of manliness, concept of archipelago, concept of national knowledge, NATIONAL DEFENSE, mind mapping and concept of nationality and two functions of ABRI (National security) and system of Hankamrata.

**LEARNING STRATEGY** :

Class meeting (lecture)

**REFERENCE** :

**SPECIFIC TOPIC FOR THESIS SUPPORT (MAB4075) 3 (0-3) credits**

**Prerequisite** : ≥ 90 credits, students have determined thesis supervisor, GPA ≥ 2, 00

**BRIEF DESCRIPSTION :**

This course is used to support research proposal writing.

**GOAL :**

Students are expected to be able to write theoretical framework, method and analysis of research data (in the form of proposal draft) according to research topic.

**TOPIC :**

1. Assignment of related literature

2. Assignment of research method skill

**LEARNING STRATEGY :**

1. To review articles/journals/textbook to write synthesis to complete basic theory of proposal and research report writing.
2. To review articles/journals/textbook to write research method to complete proposal draft and to write research report.
3. To review articles/journals/textbook to make data analysis/interpretation to complete proposal draft and to write research report.
4. Presentation of thesis proposal.
5. Understanding the lab/field research technique.

**REFERENCE:**

Based on the topic

**FOOD MICROBIOLOGY (MAB4154) 4 (2-2) credits**

**Prerequisite : MAB4250**

**BRIEF DESCRIPTION :**

This course describes the microorganism ecology, factors influencing growth and immune of microorganism within food, food damage, food-borne diseases, important microorganism for fermentation, food preservation, probiotic characteristics, and microorganism analysis method.

**GOAL :**

Students are expected to be able to understand and explain important aspect of microbiology related to food and industry, characteristic and control of microorganism growth in foodstuff, fermentation principles and food storage, probiotic characteristic and its usage, and principles of microbiology analysis and food health standard.

**TOPIC :**

Scope of food microbiology, microbial ecology within food, factors influencing microbial growth, food damage and contamination by microbe, food-borne diseases, preservation, food fermentation and its product, probiotic characteristic and its usage, microbiology test method to food, microbiological quality control and food health, HACCP.

**LEARNING STRATEGY :**

Class meeting, presentation, discussion, general lecture, laboratory work and study at food industry.

**REFERENCE :**

Adams, M.R. & M.O. Moss. 2008. *Food Microbiology*, Third Edition. RSC Publishing.; Doyle, M.P., L.R. Beuchat and T.J. 2001. *Food Microbiology*. *Fundamentals and Frontiers*. Montville, eds., ASM Press, Washington, DC.; Forsythe, S.J. 2000. *The Microbiology of Safe Food*. Blackwell Science. *Mode of instruction: Lectures and experimental work in the laboratory*.; Jay, J.M.. 2000. *Modern Food Microbiology.* Sixth Edition. Aspen Publishers,Inc., Gaithersburg, Maryland.; Ray, B. 2001. *Fundamental Food Microbiology.* Second Edition. CRC Press.; Stanbury, P.F., A. Whitaker & S.J. Hall. 2003. *Principles of Fermentation Technology,* Second Edition, Butter Worth Heinemann.

**INDUSTRIAL MICROBIOLOGY (MAB4155) 3 (2-1) credits**

**Prerequisite : MAB4250**

**BRIEF DESCRIPTION :**

This course describes the microorganism development for industry, fermentation technology development, microbiological quality control on product, primary and secondary metabolite production of microorganism.

**GOAL :**

Students are expected to be able to understand and explain important aspects of microbiology related to industry such as isolation principles of microorganism that is needed for industry, characteristics and control of microorganism in industry, principles of fermentation media and system, distribution process, safety principles on food industry standard, and application of microorganism metabolite production.

**TOPIC :**

Microbiology in industry, factors that influence microorganism work, microorganism isolation technique, fermentation media, fermentation system, microbiology quality control, organic compound production, enzyme production, antibiotic production, bio-fuel production, biomass production and industry sanitation.

**LEARNING STRATEGY :**

The learning is done in presentation with computer animation, journal discussion, lab work, study to industry, and general lecture.

**REFERENCE :**

Waites, M.J., N.L. Morgan, J.S. Rockey & G. Higton. 2001. *Industrial Microbiology: an introduction*. Blackwell Science. Stanbury,P.F., A. Whitaker & S.J. Hall. 2003. *Principles of Fermentation Technology*, Second Edition, Butter Worth Heinemann.

## TISSUE CULTURE AND ANIMAL CELL (MAB 4133) 3 (2-1) credits

**Prerequisite : MAB4137**

**BRIEF DESCRIPTION :**

This course covers the history and development of animal cell and tissue culture, finding and simple way in cell culture, explanation of instruments used in lab of animal cell culture, how cell live in in-vitro condition, primary culture, cell source and its maintenance, cell line and its maintenance.

**GOAL :**

Students are expected to be able to explain and analyze cell growth using in vitro way and they can design techniques of cell maintenance through in vitro.

**TOPIC :**

History and development of animal tissue culture, cell culture Biology, preparation and sterilization equipments, primary culture, maintenance of cell line culture, methods of cell separation.

**LEARNING STRATEGY :**

Class meeting, assignments, quiz, presentation, examination and discussion.

**REFERENCE :**

Freshney, R.I. 1987. *Culture of Animal Cells.* John Wiley & Sons Inc. Publication. New York; Dam ieres, M.C.E. et al. 1993. *In Vitro Cultivation of Animal Cells,* Butterworth Heinemann Ltd. Oxford.

## PLANT TISSUE CULTURE (MAB4123) 3 (2-1) credits

**Prerequisite : MAB4220**

**BRIEF DESCRIPTION :**

This subject covers the history, basic technique, principles and media of plant tissue culture; process and factor that influence growth and development of plant through in vitro, application of tissue culture technique and plant purification, as well science and research development.

**GOAL :**

Students are supposed to be able to understand concepts, basic techniques of tissue culture and culture type, understand and explain the fission process and cell differentiation and factors that control growth and development of plant cell and tissue, know the factors or condition that influence culture and some problems in initiation and culture maintenance and apply the tissue culture technique in supporting science and research development and plant purification.

**TOPIC :**

Introduction: concept and history of plant tissue culture, fundamentals of plant tissue culture, laboratory organization, sterilization technique, culture medium, explants selection and types of culture (callus culture, pollens/anthers culture, cell suspension culture, meristem culture, embryo culture, protoplast culture), micro-propagation: somatic organogenesis and embryogenesis and factors that influence morphogenesis, consequence of tissue culture-variability and instability: somaclonal variation, factors that influence somaclonal variation, application of tissue culture technique in plant purification, contribution of tissue culture technique in plant genetics engineering.

**LEARNING STRATEGY :**

Class meeting, lab work, assignments, presentation, discussion, visitation to entrepreneurs, and exams.

**REFERENCE :**

George E.F. 1996. *Plant Propagation by Tissue Culture*. Part 2. Exegetics Limited. England.; Edwin F. George, E.F. , M.A. Hall, G. Jan De Klerk. 2008. *Plant Propagation by Tissue Culture* 3rd Edition. Springer.; Razdan M.K. 2003. *Introduction to Plant Tissue Culture*. Science Publishers, Inc. USA.; Evan D.E., I.O.D Colemen, A Kearns. 2003. *Plant Cell Culture*. Bios Scientific Publishers. New York.; Loyola-Vargas V.M., and Vázquez-Flota F. 2006. *Plant Cell Culture Protocols*. Humana Press Inc. Totowa, New Jersey.; Narayanaswamy S. *Plant Cell and Tissue Culture*. Tata McGraw-Hill Publishing company Limited. New Delhi.; Neumann, KH, A. Kumar, J.Imani. 2009. *Plant Cell and Tissue Culture - A Tool in Biotechnology*. *Basics and Application.* Springer-Verlag Berlin Heidelberg; Smith R.H. 2000. *Plant Tissue Culture. Techniques and Experiments.* Academic Press. New York.; Trigiano R.N. & D.J. Gray. 2000. *Plant Tissue Culture Concepts and Laboratory Exercises*. CRC Press.; Chawla H.S. 2003. *Plant Biotechnology. A Practical Approach*. Science Publishers, Inc. USA.; Chawla H.S. 2002. *Introduction to Plant Biotechnology*. Science publisher, Inc. USA.

**BIOLOGICAL CONTROL (MAB4179) 4 (2-2) credits**

**Prerequisite : MAB4173**

**BRIEF DESCRIPTION :**

Biological control is one of the applications of ecology, so way of thinking of ecology is dominant in this course. Students are expected to be able to understand the ecosystem theory and stability, to search methods of stability, therefore the manipulation of organism population that create ecosystem and habitat must be conducted. Further, actions that are done for Biological control become main issue that must be mastered by students.

**GOAL :**

Students are expected to be able to apply principles of irritant organism control, find the right controls, understand the fundamental research development for this purpose and develop *learning by doing* in Biology control.

**TOPIC :**

Direction and development of Biological Control (BC), population ecology as the fundamentals of BC, actions and activities in BC, introduction, inundation, conservation, control with predator, parasitosis, and microorganism. Efforts of BC efficiency, control development through microbiology, position of BC in controlling pest, integration of pest control concept, biotechnology of BC, BC for household pest, entrepreneurship in BC, practice of traditional BC, practice of pest and natural enemy observation in the field.

**LEARNING STRATEGY :**

Discussion, class meeting, problem solving and experiment in lab work or field practice, quiz, exam, and presentation.

**REFERENCE :**

Shantharam, S., J.F. Montgomery. 1999. *Biotechnology, Biosafety and Biodiversity*. Science Publ. USA. ; Barbosa, P. 1998. *Conservation Biological Control*. Academy Press Limited. UK. Shepard, B.M.,A.T. Barrion.,J.A.Litsinger.1987. *Helpful Insects, Spiders and Pathogens.* IRRI. Manila; Huffaker, C.B. 1980. *New Technology of Pest Control*. John Willey & Sons. New York; Weage, J.,David, G. 1980. *Insect Parasitoid*. Academic Press. London; Sammways, M.J. 19981. *Biological Control of Pest and Weeds*. Edward Ardnold Publisher. London. Dixon, A. F. G. *Insect Predator-Prey Dynamics*. Ladybird Beetles and Biological Control. University of East Anglia.

**AQUATIC ECOSYSTEM MANAGEMENT (MAB4172) 3 (2-1)**

**Prerequisite : MAB4173**

**BRIEF DESCRIPTION :**

This course covers the theory and approach of field application in term of aquatic ecology, application from research for aquatic ecosystem conservation.

**GOAL :**

Students are expected to be able to explain the difference of physical, chemical and biological characteristics in aquatic ecosystem and to describe the correlation among the characteristics, to have knowledge of aquatic control, and to have ability to do research in water ecosystem management.

**TOPIC:**

Physical, chemical, and biological characteristic of fresh water ecosystem, wetland, estuary, beach and sea. Correlation between biological characteristic and physical, chemical characteristics of aquatics ecosystem. Impact of area system and man activity to aquatic ecosystem, assessment and monitoring of water quality, usage of aquatic organism as indicator of aquatic ecosystem management, policy and strategy from government in controlling aquatic ecosystem, economy and ecology perspective in managing aquatic ecosystem, case study of management and rehabilitation of aquatic ecosystem in Indonesia.

**LEARNING STRATEGY :**

Combination from interactive study, discussion, analysis training, quiz, exams, and application in laboratory.

**REFERENCE :**

Naiman, R.J. & R.E. Bilby. 2001. *River Ecology and Management Lessons from the Pacific Coastal Ecoregion*. Springer. New York. Closs, G., B. Downes & A. Boulton. 2004. *Freshwater Ecology A Scientific Introduction*. Blackwell Publishing. MA, USA. Th Duxburi, D., A.C. Duxburi, K.A. Sverdrup. 2002. *Fundamentals of Oceanography*. 4th Ed. McGraw-Hill, Boston. Castro, P., M.E. Huber. 2003. *Marine Biology Laboratory and Field Exercises*. Oxford Univ. Press, New York. Haefner, P.A. 2001. Exploring Marine Biology Laboratory and Field Exercises. Oxford Univ. Press, New York. Supriharyono. 2002. *Pelestarian dan Pengelolaan Sumber Daya Alam di Wilayah Pesisir Tropis.* Penerbit PT Gramedia Pustaka Utama, Jakarta. Goldman, C.R. & A.J.Horne. 1983. Lymnology. Mc. Graw Hill International Book Co., New York; Hynes, H.B.N. 1972. *The Ecology of Running Water.* University of Toronto Press, Toronto.; Abel, P.D. 1989. Water Pollution Biology. Ellis Horwood Limited Publishers, Chichester; Welch, E.B. & T. Lindell. 1992. *Ecological Effects of Wastewater. Applied Limnology and Pollutants Effect*. E & FN Spon, London.; Edmondson, W.T. 1959. *Fresh Water Biology*. Second Edition. John Wiley and Sons Inc., New York.; Welch, P.S. 1948. *Limnological Methods*. Mc. Graw Hill International Book Co., New York.

**ETHNOBOTANY (MAB4111) 2 (2-0) credits**

**Prerequisite** **: MAB4213, MAB4276**

**BRIEF DESCRIPTION** **:**

This course describes about ethno-botany such as potency, opportunity and the usage of plants for human welfare.

**GOAL** **:**

Students are expected to be able to explain and analyze the principles of ethno-botany and research method and to identify plants which have good price, medical value, cultural, and environmental conservation for human welfare.

**TOPIC** **:**

Fundamentals of ethnobotany, anthropology, and ecology, people's perception to plant resources, agroecosystem management and systems related to agriculture, ethnopharmacology and food resources. Working with local people, survey techniques, interview and data analysis in ethnobotany study. Reliability and validity test, cultural index.

**LEARNING STRATEGY** **:**

Student centered learning (SCL). Field trip and field trip presentation. Class meeting, laboratory work, quiz, assignment, presentation, discussion, students centered learning (SCL).

**REFERENCE** **:**

Martin, G.J. 1998, *Etnobotany, Natural History* Publications-WWF. Young, K.J. 2007. *The Green World: Ethnobotany.* Series editor Hopkins, W.G. Chelsea House Publishers. New York.; Leventin, E. 2003. *Plants and Society*. Mc Graw Hill.; Sympson, B.B. 2001. *Economic Botany*. Third edition. Mc Gaw Hill.; Minnis, P.E. 2000. *Ethnobotany: A Reader*. University of Oklahoma Press.

**FITOHORMON (MAB4127)** **3 (2-1) credits**

**Prerequisite** **: MAB4220**

**BRIEF DESCRIPTION** **:**

This course describes the kinds, characters, contributions and metabolism of plant hormone as well its application in Biology and agriculture.

**GOAL** **:**

Students are expected to be able to understand the kinds, structure, and contribution of plant hormone and apply the hormone in Biology and agriculture.

**TOPIC :**

Definition and kinds of plant hormone (auxines, gibereline, sitokinin, etylen, absisat acid, salisilat acid, jasmonat acid, brasinosteroid, poliamin, and sitemin); structure, biosynthesis, and metabolism of plant hormone; detection of endogen hormone, hormone transport and regulation within plants, contribution of hormone in plant development and growth; mechanism of cellular and molecular of hormone works on plant, application of hormone in Biology and agriculture.

**LEARNING STRATEGY :**

Class meeting, practice, assignments, presentation and discussion, exams, and quiz.

**REFERENCE :**

Srivastava, L.M. 2001. *Plant Growth and Development. Hormones and Environment*. Academic Press. New York. Krishnamoorthy, H.N. 1981. *Plant Growth Substance*. Tata Mc.Graw-Hill Pub. Co. Ltd. New Delhi; Taiz L.and E. Zeiger. 2002. *Plant Physiology*. Sinauer Associates, I nc. Publishers. Sunderland, Massachusetts. Hayat S. and A. Ahmad. 2007. *Salicylic Acid: A Plant Hormone*. Springer,Netherlands Sean Cutler S. and D. Bonetta. 2009. *Plant Hormones. Methods and Protocols*, Second Edition. Humana Press, New York. Shamsul Hayat S. and A. Ahmad. 2011. *Brassinosteroids: A Class of Plant Hormone*. Springer Dordrecht Heidelberg London New York.

**SURVEY AND MANAGEMENT OF NATURAL RESOURCES DATA 4 (1-3) credits (MAB4007)**

**Prerequisite : MAB4276**

**BRIEFT DESCRIPTION :**

This course provides explanation about the technique of primary and secondary data collection, design of survey technique based on tropical field study, practice of population analysis technique, practice of community and ecosystem through qualitative and quantitative in the field and laboratory. Practice of data management and specimen.

**GOAL :**

Students are expected to be able to design, apply and increase work experience in a team for collection technique, restore, and analysis of natural resource data.

**TOPIC :**

Introduction: design the survey technique based on tropical field study. Introduction study, practice of structure analysis technique and population function, community and ecosystem in water,

land, spatial and temporal in qualitative and quantitative. Collection of sample from the practice place, transportation, management of natural resources sample, collection data management, data digitalization, theory and sample of natural resources utilization, analysis of natural resource data, data catalogue, data report and presentation.

**LEARNING STRATEGY:**

Combination of interactive study and discussion from assignments presented by a group, problem solving and practice of data analysis used to develop scientific skill and application in the laboratory and field. Evaluation: quiz and exam used to evaluate the students' knowledge, understanding and ability.

**REFERENCE:**

Kumar, H.D. 1999. *Biodiversity and Sustainable Conservation.* Science Publ. Inc., New Hampshire. Conston, D.R.,1988. *An Introduction to Vegetation Analysis.* Unwin Hyman, London; Krebs, C. 1989. *Ecological Methode*. Harper and Prw Publ. New York; Purvis, A. & A. Hector. 2000. *Getting the measure of biodiversity*. Nature 405: 212-219. Dobson, A. 1997*. Biodiversity and the future of democracy*. Tree 12 (1) : 39-40; Gaston, K.J. 2000. *Global patterns in biodiversity.* Nature 405: 220-227.

**IMMUNOLOGY (MAB4139) 3 (3-0) credits**

**Prerequisite : MAB4137**

**BRIEF DESCRIPTION :**

This course describes the immune system and immune-competent cellular, pathological mechanism that engages immune system and its application in reproduction.

**GOAL :**

Students are expected to be able to explain and analyze immunology basic system and response.

**TOPIC :**

(1) Introduction: general characteristics of immune respond, cell, and tissue in the immune system (2) introduction to antigen and antibody (3) limfosit maturation and activation (4) mechanism of immune respond effecter : sytokin, innate immunity (5) hypersensitivity and allergy (6) cancer immunity (7)HLA system (8) immune-deficiency and autoimmune (9) reproduction immunology.

**LEARNING STRATEGY:**

Class meeting, practice, laboratory work, assignments, quiz, presentation, discussion and exams.

**REFERENCES:**

Abbas, A.K., Lichtman, A.H. and Pober, J.S., 2000, *Cellular and Molecular Immunology,* W.B. Saunders Co., Toronto; Harlow, E. and Lane, D., 1988, *Antibodies A Laboratory Manual*, Cold Spring Harbor Laboratory, USA; Roitt, I.M. and Delves, P.J., 2001, *Essential Immunology,* Blackwell Science; Roit, I., Brostoff, J., and Male., D., 2001, *the Immunology*, 7th ed., Mosby Publ.

**MEDICINAL HERBS (MAB4112) 2 (2-0) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course covers the explanation about plants that can be medicine, interaction of active compound inside cell, potential and utilization opportunity.

**GOAL :**

Students are expected to be able to explain the kinds of medicinal herbs, utilization and physiological aspect in man's body.

**TOPIC :**

The origin or history of medicinal herbs usage, medicinal herbs in Indonesia, development of medicinal herbs industry, socialization process of medicinal herbs usage, agribusiness potency of medicinal herbs, challenge and obstacle of its development, chemotaxonomy and classification of medicinal herbs, Phytomic and metabolomic, Study of drug yielding plants from the following groups {Algae (Gelidium, Gracilaria, Pterocladium & Diatoms), Pteridophytes (Polypodiaceae) Gymnosperms (Pinaceae & Ephedraceae) and Angiosperms (Ranunculaceae, Papavaraceae, Leguminosae, Rutaceae, Umbelliferae, Apocynaceae, Asclepiadaceae, Solanaceae, Labiatae, Liliaceae and Zingiberaceae}. Poisonous and hallucinogenic plants. A brief outline of isolation, Identification, distribution of therapeutic effective and pharmaceutical applications of secondary metabolites, Polyphenolics, Alkaloids, Terpenoids & Steroids. Characteristics and interaction of active compound within cell. Crude drugs and isolated compounds. Basic principles involved in the phytochemical and biological screening of plant drugs in: Analgesics, anti-inflammatory, cardiotonic, hypoglycemic drugs and plant immodulators. Bioactivity: Activity versus toxicity, Rapid screening method, brine shrimp bioassay, insilico, invitro and invivo bioassay. Extraction, Isolation and characterization by chemical and spectral means of various active principles having edicynal, industrial and clinical importance from the following categories: Alkaloids, glycosides, steroids, antibiotics, vitamins, terpenoids, lipids, volatile oils, coumarins and photosensitizing agents. Formulations and dosage forms of medicinal herbs in different systems of medicine. Medicinal herbs abuse and repercussions. From plant from "crude extract" to "single compound" drug industry.

**LEARNING STRATEGY :**

Class meeting, quiz, assignments, discussion, and survey at field, student centered learning (SCL).

**REFERENCE :**

*Therapeutic Guide to Herbal Medicines*, Mark Blumenthal, Senior Editor, American Botanical Council, *Integrative Medicine Communications*, Boston, Massachusetts (1998). Health Science Library (HSL). Rational Phytotherapy, *A Physicians Guide to Herbal Medicine,* V. Schulz, R. Haensel, V.E. Tyler, Springer Publishers, Berlin, ISBN: 3-540-67096-3. *Botanical Medicines, The Desk Reference for Major Herbal Supplements,* D.J. McKenna, K. Jones, K. Hughes, The Haworth Herbal Press, New York, ISBN: 0-7890-1265-0. *Natural Medicines Comprehensive Database* (www.naturaldatabase.com)

**POPULATION GENETICS (MAB4164) 2 (2-0) credits**

**Prerequisite : MAB4261, MAB4173/ MAB4142**

**BRIEF DESCRIPTION :**

This course is a general introduction to empirical and theoretical genetics population that discusses about main power and process in forming genetic variation and evolution process on natural population (mutation, drift, selection, migration, recombination, married pattern, population measurement and subdivision from population), and method of genetic variation measurement, understand the inter genetic variation formation and intra population as the part of conservation strategy and therapy management of genetic abnormality based on the molecular population analysis.

**GOAL :**

Main goal of this course is to make students familiar to basic model of population genetics and it can introduce the empirical test from population genetic model.

**TOPIC :**

Models of genetics population, probability and distribution, genetic and variation of phenotypic, Hardy Weinberg law, measuring genetic variation, selection: basic diploid model, domination, heterosis (heterozigonity and homozigonity) and underdominnance, X-linked, haplodiploid, double alel, estimation from natural population, ecology genetics, drift genetics: binomial sampling, drift genetics and effective population measurement, mutation: basic idea, mutation-selection balance, balance between mutation and drift, mutation rate estimation, molecular population genetic: neutral theory, coalescent process, selection test, population structure: migration model, estimation of gene flow, Non-random mating, Linkage disequilibrium and recombination, multilocus selection, molecular variation on human, quantitative traits and association study.

**LEARNING STRATEGY :**

Class meeting, assignments, quiz, student centered learning (SCL) through presentation, and discussion.

**REFERENCE :**

Hartl DL & Clark AG 2007 *Principles of Population Genetics*, 4th Edition. Sinauer Associates: Sunderland, Massachusetts Journal (Discussion Readings) Genetic Variation Kreitman M (1983) *Nucleotide polymorphism at the alcohol-dehydrogenase locus of Drosophilamelanogaster.* Nature 304, 412-417. Perry GH, Dominy NJ, Claw KG, et al. (2007) *Diet and the evolution of human amylase gene copy number variation.* Nature Genetics 39, 1256-1260. {incl. Novembre J, Pritchard JK, Coop G (2007) *Adaptive drool in the gene pool*. Nature Genetics 39, 1188-1190.}

**ANALYTICAL TECHNIQUE OF MOLECULAR BIOLOGY (MAB4263) 4 (2-2) credits**

**Prerequisite : MAB4261**

**BRIEF DESCRIPTION :**

This course explains the observation and analysis of molecular by using analytical technique of molecular Biology that is presented in lab work and lecture. The subjects given are basic techniques of molecular Biology such as DNA and protein isolation, gene manipulation, PCR, RFLP, technique of creating DNA Recombinant, sequencing, electrophoresis, and immune-histochemical, western blotting.

**GOAL :**

After taking this course, students are supposed to be able to explain and apply basic technique of molecular Biology such as DNA and protein isolation, gene manipulation, PCR, RFLP, technique of creating DNA recombinant, sequencing, electrophoresis, and immune-histochemical, western blotting.

**TOPIC :**

Introduction, basic concept of molecular Biology analysis, basic technique of bacteria/fungus DNA isolation, plant, animal, and man tissue. Gene amplification with techniques PCR, RT-PCR, RAPD. Gene manipulation: RFLP and mutation analysis. Basic technique of creating DNA recombinant, basic technique of biological material detection: Southern, Northern, Western Blot. DNA sequencing and real-time PCR, basic technique of protein isolation and precipitation, of electrophoresis protein and nucleate acid, protein analysis method, antigen-antibody, immune-bloting and immune-histochemical, analysis of DNA and protein alignment, Laboratory safety, and chemical handling.

**LEARNING STRATEGY :**

**L**ab work, study by using power point and animation, practice and lecture note, assignments, quiz, presentation, discussion and student centered learning (SCL).

**REFERENCE :**

Brown, TA.1991. *Gene Cloning and Introduction.* Van Nostrand Rheinhold, UK.; Goers,J. 1993. *Immunochemical Techniques Laboratory Manual*. Academic Press Inc., California; Fatchiyah, Arumingtyas EL, Widyarti S, Rahayu S, 2010. *Dasar-dasar Analisis Biologi Molekuler*. Universitas Brawijaya, Malang. Harlo, E dan Lane D. 1998. *Antibodies : A Laboratory Manual*. Cold Spring Harbour Laboratory, New York; Innis M.A., Gelfand DH., Sninsky JJ. *PCR Application Protocol for Functional Genomics*. Academic Press. New York; Robyt, J.F dan White, B.J. 1987. *Biochemicals Techniques : Theory and Practice*. Brooks/Cole Publishing Co., California.; Wilson, K. dan J. Walker. 2004. *Principles and Techniques of Practical Biochemistry.* 4th Edition. Cambridge University Press. Cambridge.

**ECOTOXICOLOGY (MAB4277) 3 (2-1) credits**

**Prerequisite : MAB4173**

**BRIEF DESCRIPTION :**

This course presents the theoretical and practical explanation about eco-toxicology, application of instruments and procedures used in a research related to eco-toxicology in evaluating environment quality through toxicity test.

**GOAL :**

After taking eco-toxicology course, students are supposed to be able to explain environmental toxicological aspects and impact of pollutant to organism, population, community and ecosystem. Besides, they can also explain the English literature that is relevant, practice the research method and show it in scientific media.

**TOPIC :**

Introduction to eco-toxicology vs classical toxicology and eco-toxicological aspects, Major classes of chemical pollutants, toxicity of pollutants and major entry of pollutant into Ecosystem, Fate of Organic Pollutants in Individuals and in Ecosystem, Fate of Metals and Radioactive Isotopes in Contaminated Ecosystem, Effects of Pollutants on Individual Organisms (procedure of toxicity research test and its application in organism level), Lethal and sub-lethal Responses to Chemicals, Effects of Pollutants on Populations, Communities and Ecosystem, Bio-indicators and Bio-markers, effects of pollutant toxic to microorganism community, effects of pollutant toxic to plant and animal community either in land or water.

**LEARNING STRATEGY :**

Discussion from presented assignments, problem solving and practice of data analysis used to develop scientific ability and its application in laboratory and field, exam and quiz to evaluate student ability.

**REFERENCE :**

Butler, G.C. 1978. *Principles of Ecotoxicology* SCOPE 12. John Wiley and Sons, New York. ; de Kruijf, H.A.M, D. de Zwart, P.K. Ray, P.N. Viswanathan, 1988. *Manual on Aquatic Ecotoxicology.* Kluwer Academic Publishers, London.; Moriarty, F. 1988. *Ecotoxicology, The Study of Pollutants in Ecosystems.* Academic Press, London.; Connel, Des. W. & G.J. Miller. 1995. *Kimia dan Ekotoksikologi Pencemaran. Diterjemahkan dari: Chemistry and Ecotoxicology of Pollution oleh Koestoer*, Y. Penerbit Univ. Indonesia, Jakarta.; Lu, F. C. 1991. *Basic Toxicology. Fundamentals, Target Organs, and Risk and Assessment.* 2nd Edition. Hemisphere Publishing Corporation, Washington. Walker C. H. et al., 1996. *Principles of ecotoxicology.* Tylor and Francis, London, UK

**SOCIAL ECOLOGY (MAB4278) 2 (2-0) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course covers the basic definition of social ecology such as social values, tradition and social regulation, social factors that influence environmental problem, impact of society to environment and finding a way to solve the problem. It also describes the social process related to actual environmental problems, approach method to society to solve the environmental problems.

**GOAL :**

Students are supposed to be able to apply social ecology principles in solving environmental problems.

**TOPIC :**

Basic definition of environmental ecology such as social values, tradition and social regulation in society, culture and role of social organization in solving environmental problems, some approach methods to people to solve environmental problems, method of RRA, PRA, and other sociological methods. Some Biology principles issue that can be applied in social life, evaluation of the success of social ecology approach.

**LEARNING STRATEGY :**

Subjects of this course are written in power point presented in LCD and OHP. To evaluate student, lecturer gives quiz, exam, and assignment.

**REFERENCE** : conditional

**PLANT BIOTECHNOLOGY (MAB4221) 3 (2-1) credits**

**Prerequisite** : -

**BRIEF DESCRIPTION** :

This course describes the basic definition, principles, technique and application of plant biotechnology.

**GOAL** :

Students can understand the usage of living thing in the engineering/technology process to produce useful plant product.

**TOPIC** :

Introduction: definition, history and scope of plant biotechnology, DNA recombinant within plant; transformation technology of plant; gene transfer chained by agro-bacterium; Agro-bacterium based vectors, viral vectors and its application. Method of direct gene transfer, chemical method, electro-phoration, microinjection, particle bombardment, selection and regeneration of transgenic plant: media manipulation, subculture, and selection, screen-able marker assay, regeneration and transplanting, molecular genetics and expression assay, transgenic plant growth in gauze house and in the field area. Plant genetic engineering for productivity and performance in the biotic stress condition: resistance to herbicide, insect, disease and virus resistance; plant genetic engineering for productivity and performance in abiotic stress condition: tolerance to dryness, temperature and salt. Metabolic engineering: metabolic engineering: metabolic engineering for product of plant secondary metabolite. Molecular Farming and Industrial Product: application of plant biotechnology for production of proteins, enzyme, and plant vaccine. Transgenic plant prospect: development of transgenic plant today, regulation about GM corps and products, development of plant biotechnology in the future.

**LEARNING STRATEGY** :

Class meeting, practice, assignment, presentation and discussion. Plant biotechnology subjects are presented in the form of power point using LCD and hand out. Assignments are given to let students know about basic definition, principles, technique and plant biotechnology application. Practice/lab work is instructed to make students apply the theory and to evaluate their ability, lecturers give quiz and exams.

**REFERENCE** :

Slataer A., N.Scott, M. Fowler. 2003. *Plant Biotechnology. The genetic manipulation of plants*. Oxford university Press. Chawla H.S. 2003. *Plant Biotechnology. A Practical Approach.* Science Publishers, Inc. USA. Chawla H.S. 2002. *Introduction to Plant Biotechnology*. Science publisher, Inc. USA. Galun, E., and Breiman A. 1998. *Transgenic Plants*. Imperial College Press. London. Srivastava, P.S., A. Narula, S. Srivastava. 2005. *Plant Biotechnology and Molecular Markers*. Kluwer Academic Publishers, New York.

**ANIMAL REPRODUCTIVE BIOLOGY (MAB4234)** **3 (2-1) credits**

**Prerequisite** **: MAB4137**

**BRIEF DESCRIPTION** **:**

This course covers the reproductive system on vertebrate and invertebrate animal.

**GOAL** **:**

Students are expected to be able to explain the animal reproductive system through comparative way.

**TOPIC** **:**

Modes of reproduction, integration and urogenital structure, reproductive regulation, embryo nutrition and placentation, offspring care, marriage system and environmental influence, sexual disfunction, fertility and infertility as well the sexual differentiation.

**LEARNING STRATEGY** **:**

Class meeting, practice, assignments, quiz, presentation, discussion and exams.

**REFERENCE** **:**

Johnson, Martin H and Everitt Barry J. 1980. *Essential Reproduction*. Blackwell Scientific Publication, Oxford. London ; Havez E.SE. *Human Semen and Fertility Regulation in Men*. The C.V. Mosby Company, America ; Nancy W.D, David Ona Dagno. 1995. *Human Sexuality*, Mosby year Book, Chicago; Williams H.M, Virgine E.J, Robert C.K. 1994. *Human Sexuality*. Harper Collins Publishes, New York; Caulwell, D.O. 1965. *Transferstian, Sexology corporation*. New York; Krafft, Ebing. R.W. 1965. *Aberration of Sexual Life. The Psychopathic Sexuals.* Panther Books. London

**VACCINE TECHNOLOGY (MAB4235)** **2 (2-0) credits**

**Prerequisite** **: MAB4160, MAB4137, MAB4139**

**BRIEF DESCRIPTION** **:**

This course describes the technology of vaccine production from DNA conventional, recombinant, and vaccine.

**GOAL** **:**

Students are supposed to be able to understand and explain the basic principles of vaccine production.

**TOPIC :**

History of vaccine technology development, antigen-antibody bond, antigen introduction by cell B, antigenecity, antigen processing and its percentage from genome to vaccine, genetic diversity, and mechanism of pathogen slip from immunocompetent cell, epitopep map based on alkali order and three-dimension structure. Peptide formation design for immunization, DNA vaccine design, DNA vaccine adjuvant, immune-stimulator formation, natural-synthetic immune-stimulator, antigen conduction strategy in immunization, adjuvant mucosa, adjuvant on vaccine for non-infection disease.

**LEARNING STRATEGY :**

Class meeting, quiz, assignments, presentation and discussion as well student centered learning (SCL).

**REFERENCE :**

*Modern vaccine*, Elsevier, USA. Mark Saltzman, Hong shen and Janet L. Brandsma, *DNA Vaccine: methods and protocols*, 2006, Human press, USA. Flower Darren R. *Bioinformatics for Vaccinology* Publisher: UK, John Wiley & Sons Inc. 2008. ISBN: 9780470027110. Flower Darren R. *Immunoinformatics: Predicting Immunogenicity In Silico* Publisher: New Jersey,Humana Press. 2007. ISBN: 9781603271189. Kindt, Thomas th J.,Osborne Barbara A.Goldsby Richard A. Kuby *Immunology* 6th Edition. Publisher: New York, W. H. Freeman. 2007. ISBN: 9780716785903. Lund Ole, Nielsen Morten, Lundegaard Claus, Kesmir Can, Brunak SÃ¸ren. *Immunological Bioinformatics.* Publishesr: London, MIT PRess 2005 ISBN: 0262122804. Foundation Novartis. *Immunoinformatics: Bioinformatic Strategies for Better Understanding of Immune Function*. Publisher: Chichester,John Wiley & Sons Inc. 2003. ISBN: 0470853565. Roitt Ivan, Delves Peter. Roitt's *Essential Immunology* 10th Edition.Publisher: Canada,Blackwell. 2001, ISBN: 0632059028. Ellis Ronald W. *Vaccines: New Approaches to Immunological Problems.* Publisher.

**ENVIRONMENTAL MICROBIOLOGY (MAB4253) 3 (2-1) credits**

**Prerequisite : MAB4250**

**BRIEF DESCRIPTION :**

This course has 3 credits (2 credits for theory and 1 credit for practice) and the prerequisite is students have taken General Microbiology (MAB4250). Environmental microbiology began in 1960 because the increasing of specialization centered to environment. Nowadays, many environmental issues happen and the solutions are related to microbial component in global ecosystem. Therefore, application of environmental microbiology exists to give and to increase student's competence in terms of role, ability, microbial usage technique to solve problems for increasing environmental quality.

**GOAL :**

Students are expected to be able to explain the microbial contribution for environment and the impact of environmental factors to microbe community, to analyze conventional and modern technique to detect the diversity and activity of microbe in the environment and to discuss the problem in scientific forum.

**TOPIC :**

Development and the importance of microbe in the environment, respond and adaptation (eco-physiology) of microbe to the environmental factor stress. Microbial community and ecosystem. Interaction among microbial populations and microbial interaction with animal and plant. Microbe's role in biogeochemical cycle, Microbe as determiner bio-indicator of environmental quality, biotechnology aspects in the environmental microbiology: a) waste control b) control of natural resources bio-deterioration c) control of pest population and disease cause d) recovery of natural resources and energy production through microbiological way. Bioremediation of polluted ecosystem. Biomass measurement and activity of microbe in the environment. Molecular biology approach to study the biodiversity and activity of microbial community in the environment.

**LEARNING STRATEGY :**

Discussion, lab work, practice, journal presentation, class meeting

**REFERENCE :**

Nd Alexander, M. 1999. *Biodegradation and Bioremediation.* 2nd ed. Academic Press, San Diego.; Atlas, R. M. And R. Bartha. 1998. *Microbial Ecology*: *Fundamentals and the Applications*. 4th Ed., Addison & Wesley, Longman.; Hurst, C. J., R. C. Crawford, G. R. Knudsen, M. J. McInerney, and L. D. Stetzenbach. 2002. *Manual of Environmental and Microbiology*. 2nd ed. ASM Press, Washington.; Laskin, A. I., S. Sariaslani, and G. M. Gadd. 2007. *Advances in Applied Microbiology.* Vol65. Elsevier Inc., Amsterdam.; Maier, R. M., I. L. Pepper, and C. P. Gerba. 2000. *Environmental Microbiology*. Academic Press Elsevier, New York.; Sylvia, D. M., J. Fuhrmann, P. G. Hartel, and D.A. Zuberer. 1999. *Principles and Applications of Soil Microbiology*. Prentice Hall Inc., USA.; Van Elsas, J. D., J. T. Trevors, and E. M. H. Wellington. 1997. *Modern Soil Microbiology*. Marcel Dekker Inc., New York.

**MICROBIAL DIVERSITY (MAB4251) 3 (2-1) credits**

**Prerequisite : MAB4250**

**BRIEF DESCRIPTION :**

This course is an optional course with prerequisite MAB4250. It covers the microbial diversity that contains with microbial evolution, classification and concept of microbial species such as prokaryotic and eukaryotic, microbial contribution in the ecosystem, microbial exploration by using molecular approach,

microbial diversity in extreme environment and bio-prospect of microbial diversity for human and environment.

**GOAL :**

Students are expected to be able to understand and explain aspects of microbial diversity, microbial evolution, classification and concept of microbial species prokaryotic and eukaryotic; microbial contribution in the ecosystem, microbial exploration with molecular approach, microbial diversity in the extreme environment and bio-prospect of microbial diversity.

**TOPIC :**

**I**ntroduction to microbial diversity, classification and species concept, microbial contribution in the ecosystem, how to look and where to look, culture dependent and independent, meta-genomic approach, microorganism in extreme habitat, bacteria diversity, arcae, protozoa, micro-algae and fungi, and bio-prospect of microbial diversity.

**LEARNING STRATEGY :**

Class meeting, presentation, journal discussion, practice in the either laboratory or field.

**REFERENCE:**

Bull, A. 2003. *Microbial Diversity and Bio-prospect*. ASM Press, Washington, DC.

**COMPUTATIONAL BIOLOGY (MAB4279) 3 (2-1) credits**

**Prerequisite : MAB4100, MAI4280**

**BRIEF DESCRIPTION :**

This course covers the computational biology with problem-based-learning approach; structure, type, analysis, model and data computation. System modeling and stimulation are the new interest in Biology, one of the applications is to handle the limitation of test object, location and risk for the researcher. The computer usage also helps the large data process by merging computation and database management.

**GOAL :**

After taking this subject, students are expected to be able to apply the principles of data process based on information technology. In the first steps, students can understand some tools that are regularly used in Biological Computation. Then, they are able to design the tool according to their research.

**TOPIC :**

Biological data process, structure and system of biological data. Analysis of biological data, model and simulation of biological data, analysis practice of parametric and non parametric variant data, difference testing, correlation and regression practice, interpretation for the result of computation data analysis.

**LEARNING STRATEGY :**

Class meeting, discussion, problem solving, experiment in laboratory and field, evaluation: quiz, exam, presentation and discussion.

**REFERENCE :**

Relevant books

**BIOINFORMATICS (MAB4265) 3 (1-2) credits**

**Prerequisite : MAB4261, MAB4276, MAI4280**

**BRIEF DESCRIPTION :**

This course is necessarily learned to understand the analysis technique for bioinformatics as science that aims to apply computational technique to process and analyze biological information, informatics method application (in silico) to solve biological problems, particularly by using DNA sequence and amino acid as well information that is related to interaction among molecules.

**GOAL :**

Students are supposed to be able to understand the correlation between Biology subjects and computation. They are good at using software and making small utility in solving biological problem by using in silico analysis.

**TOPIC:**

Introduction to in silico analysis such as introduction to database operation to save and to take the data searching and browsing database, exploration of protein and DNA sequence, mapping of enzyme restriction map, to design DNA primary, analysis of alignment by using BLAST method, bioedit or clustal-X2, analysis of protein sequence: prediction of 2D and 3D protein structure, superimpose, to predict the protein structure form or RNA secondary structure, phylogenetic analysis, analysis of gene expression, interaction analysis of gene and protein, virtual screening and drug design.

**LEARNING STRATEGY:**

Class meeting, demonstration, practice by using computer and internet in tutorial and demonstration (web laboratory).

**REFERENCE:**

Aluru, Srinivas, ed. 2006, *Handbook of Computational Molecular Biology,* Chapman & Hall/Crc; Baldi, P and Brunak, S., 2001, *Bioinformatics: The Machine Learning Approach* 2nd ed., MIT Press; Barnes, M.R., and Gray, I.C., eds., 2003, *Bioinformatics for Geneticist*, Willey and Son; Pevzner, Pavel A., 2000, Computational

**INTRODUCTION TO BIOPHYSIC (MAB4240) 3 (2-1) credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course describes the explanation of electricity and magnet in Biology (heart and other organs), concept about thermo, thermodynamic, Biology sensor system (ear, eyes, nerve, communication with insects), bioelectricity within cells and organs, transport system within creature, energy conversion in membrane transport, energy conversion in Biology (photosynthesis, energy transfer efficiency in plant and animal, radioactivity (radiation, tracer system, etc)

**GOAL :**

Students are supposed to be able to explain the basic principles of biophysics, to practice the biophysics research method and present it in scientific communication.

**TOPIC :**

Electricity and magnet in Biology (heart and other organs), concept about thermo, thermodynamic, sensor system Biology (ear, eyes, nerve, communication with insects), bioelectricity inside cell and organs, transport system in the creature, energy conversion in membrane transport, energy conversion in Biology (photosynthesis, energy transfer efficiency in plant and animal, radioactivity (radiation, tracer system, etc)

**LEARNING STRATEGY :**

Class meeting, assignments, exams, practice, quiz, and discussion.

**REFERENCE :**

Ackerman, E. 1979. *Biophysical Science*. Prentice Hall. London.; Setlow, R.B., Polard, E.C. 1978. *Molecular Biophysics*. Addison Wesley.; Kleiber, M. 1961. The Fire of Life. *An Introduction to Animal Energetics* John Wiley & Sons, Inc. New York.; Sybesmi, C. 1989. *Biophysics. An Itroduction.* Kluwer Acad. Publ. Den Haag.; Gates, D.M. 1980. *Biophysical Ecology*. Springer-Verlag. New York.; Cameron, J.R. Skofranick, J.G. Roderick, G. 1980. *Medical Physics of the Body*. Madison Publ. Wisconsin.

**ISLAMIC RELIGION EDUCATION (UNG4001)** **3 (3-0) credits**

**Prerequisite** **: -**

**BRIEF DESCRIPTION** **:**

This course covers the explanation about understanding al Qur'an and science about life creation, earth and universe creation. Explanation about man and religion such as status and function of man, contribution of religion in life, *aqidah islamiyyah (faith), tauhid (oneness), syari'ah islamiyah (Islamic law), muamalah (trade), arkanul iman (faith), akhlaqul karimah (ethics), madsummah, and Islamic history.*

**GOAL** **:**

After taking this course, students are expected to be able to explain the correlation among religion, man and science and understand the important role of religion in this life.

**TOPIC** **:**

Al Qur'an and science about life creation, earth and universe creation. Explanation about man and religion such as status and function of man, contribution of religion in life, *aqidah islamiyyah (faith), tauhid (oneness), syari'ah islamiyah (Islamic law), muamalah (trade), arkanul iman (faith), akhlaqul karimah (ethics), madsummah, and Islamic history.*

**LEARNING STRATEGY** **:**

Class meeting, practice, quiz, assignments, quiz, presentation, discussion, and student centered learning (SCL)

**REFERENCE: -**

**CHRISTIAN PROTESTANT EDUCATION (UNG4002)** **3 (0-3) credits**

**Prerequisite** **: -**

**BRIEF DESCRIPTION** **:**

This course describes the ways of developing faith to make students become good persons. Ways of improving responsibility to God through awareness of human and environment. Therefore, students can participate in social life for the sake of God blessing.

**GOAL** **:**

After taking this course, students can explain the correlation among religion, man and science and they can understand the importance of religion in this life.

**TOPIC :**

Ways of developing faith to make students become good persons. Ways of improving responsibility to God through awareness of human and environment. Therefore, students can participate in social life for the sake of God blessing.

**LEARNING STRAETGY :**

Class meeting, practice, quiz, assignments, presentation, and discussion.

**REFERENCE : -**

**CHATOLIC EDUCATION (UNG4003) 3 (0-3) credits**

**Prerequisite : -**

**BRIEF DECSRIPTION :**

This course presents the explanation about faith concept in church, church life, and social life to improve students' personality who can do the best for their country as the representation of their faith.

**GOAL :**

Students are expected to be able to explain the correlation among religion, man, and science and they can understand the contribution of religion in personal life, social life and country.

**TOPIC :**

Explanation about faith concept in church, church life, and social life to improve students' personality who can do the best for their country as the representation of their faith.

**LEARNING STRATEGY :**

Class meeting, practice, quiz, assignment, presentation and discussion.

**REFERENCE : -**

**HINDUISM EDUCATION (UNG4004) 3 (0-3) Credits**

**Prerequisite : -**

**BRIEF DESCRIPTION :**

This course covers the history of Hinduism, Hinduism three dharma; tatwa (philosophy), susila (ethics), yadya (ritual), Weda, basic faith of Hinduism, panca srada, dharma sidharta, basic principles and purpose of life, catur marga yoga, panca maha yadya, catur asrama, catur warna.

**GOAL :**

After taking this course, students are supposed to explain the correlation among religion, man and science, and they can understand the religion contribution in personal life, social life and country.

**TOPIC :**

History of Hinduism development, three dharma of Hinduism, Hinduism three dharma; tatwa (philosophy), susila (ethics), yadya (ritual), basic faith of Hinduism, panca srada, dharma sidharta, basic principles and purpose of life, catur marga yoga, panca maha yadya, catur asrama, catur warna.

**LEARNING STRATEGY :**

Class meeting, practice, quiz, presentation, and discussion.

**REFERENCE:-**

**BUDDHISM EDUCATION (UNG4005) 3 (0-3) credits**

**Prerequisite : -**

**TOPIC :**

This course covers the explanation about Buddhism history, epistemology, causality, life characteristics, birth karma, morality and ethics, nirvana, ideology characteristics, metaphysics, theology, position of Buddhism in man's knowledge, the relevance of Buddhism in modern and Indonesia development era.

**GOAL :**

Students are able to explain the Buddhism education, the correlation among religion, man, and science and they can understand the religion contribution in personal life, social life, and country.

**TOPIC :**

Buddhism history, epistemology, causality, life characteristics, birth karma, morality and ethics, nirvana, ideology characteristics, metaphysics, theology, position of Buddhism in man's knowledge, relevance of Buddhism in modern and Indonesia development era.

**LEARNING STRATEGY :**

Class meeting, practice, quiz, assignments, presentation and discussion.

**REFERENCE :-**