MINISTRY OF EDUCATION AND TRAINING
CAN THO UNIVERSITY

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

SUBJECT OUTLINE DETAILS

1. Subject: Fundamental Genetics

- **Code:** ZO341C
- **Credits: 03**
- **Hours:** 45 theory hours, 90 self-study hours.

2. Management Unit:

- **Department:** Molecular Biotechnology
- **Faculty/School/Institute/Center/Department:**

Biotechnology Research and Development Institute, Can Tho university

3. Prerequisites: Biochemistry I (BC461C) and Biochemistry II (BC462C);
General Biology I (BS110C) and General Biology II (BS111C).

4. Subject objectives:

The purpose of this course is to provide students: (1) basic theoretical information about genetics, (2) the study of heridity; (3) current understanding of genes at molecular level;

4.1. Knowledge:

Students will develop knowledge and understanding of:

4.1.1. The principles of inheritance in living organisms;

4.1.2. The principles of variation in living organisms;

4.1.3. The concepts of gene at molecular level.

4.2. Skill:

4.2.1. increases awareness of different levels of thinking: comprehension, application, and evaluation.

4.2.2. apply investigative and problem-solving skills.

4.3. Attitude:

4.3.1. Students are encouraged to develop positive values and informed critical attitudes.

4.3.2. Students must have a positively sense in the self-learning

5. Brief description of subject content:

This course will acquaint students with the key inheritance and variation processes underlying the activity of living systems. Topics include the modes of inheritance, variation and mutation, quantitative genetics, population genetics, bacterial genetics, mechanism of regulation and expression of genes.

6. Subject content structure:

6.1. Theory

Contents	Hours	Objectives
Chapter 1. Introduction to Genetics 1.1. Branches of Genetics 1.2. Central Dogma: DNA and RNA structure 1.3. DNA replication 1.4. Transcription process 1.5. Genetic code and Translation process	**3**	**4.1.1** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 2. Mutations and DNA repair 2.1. Mutation types and their impacts on phenotype 2.2. DNA mutation during replication 2.3. Repair mechanism of DNA damage	**3**	**4.1.2** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 3. Transposable elements 3.1. General characteristics 3.2. DNA transposons 3.2.1. Transposable elements in bacteria 3.2.2. Transposon in Maize: Ac/Ds system 3.2.3. Transposon in Drosophila 3.2.4. Retrotransposon only in Eukaryotes	**3**	**4.1.1** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 4. Biosynthetic pathway, Auxotrophy, Complementation 4.1. Biosynthetic pathway: Beadle & Tatum' experiments 4.2. Auxotrophy 4.3. Complementation test	**3**	**4.1.3** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 5. Bacterial Genetics 5.1. Bacterial Genome 5.2. Transformation 5.3. Conjugation 5.4. Transduction	**3**	**4.1.1** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 6. Gene Regulation, Bacterial Lac Operon 6.1. Overview of gene regulation 6.2. Regulated Gene expression 6.3. Lactose Operon 6.4. Regulatory mutations	**3**	**4.1.3** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 7. Mitosis and Meiosis 7.1. Nuclear division: Mitosis, Meiosis 7.2. Cell Life Cycle 7.3. Simple genetic crosses in diploid organisms 7.4. Dihybrid crosses 7.5. Probability and Goodness of fit: Chi-square test	**3**	**4.1.1** **4.2.1** **4.2.2** **4.3.1** **4.3.2**

Chapter 8. Quantitative Genetics 8.1. Continuous versus Discontinuous characters 8.2. Statistical measurements: Mean, Standard Deviation, CV% 8.3. Tremendous changes in inquantitative traits under selection 8.4. G x E interaction analysis model	**3**	**4.1.1** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 9. Sex determination and Sex linkage; Sex influenced and sex limited traits 9.1. Genetic basis of sex determination 9.1.1. Expression of both sexes in one individual 9.1.2. Sex determination in animals 9.2. Chromosomal system for sex determination 9.2.1. XX-XO system in grasshoppers 9.2.2. ZZ-ZW system in birds, some amphibians & fish 9.2.3. Haplodiploidy system in Hymenopteran insects 9.3. Sex linkage 9.4. Sex influenced and limited traits	**3**	**4.1.1** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 10. Exceptions to the standard dominance & recessive relationships 10.1. Phenotype does not always reflect the genotype 10.1.1. Penetrance 10.1.2. Expressivity 10.2. Environment may affect phenotype development 10.2.1. Degree of dominace 10.2.2. Incomplete dominance 10.2.3. Codominance 10.2.4. Epistasis 10.2.5. Gene lethal 10.3. Genes interacting and altering the phenotypic ratios	**3**	**4.1.1** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 11. Chromosome Variation: Rearrangment & Number 11.1. Terminology for chromosomal structure 11.2. Types of Changes in chromosome structure 11.2.1. Duplications & Deletions 11.2.2. Inversions 11.2.3. Translocations 11.3. Genetic & evolutionary impact of chromosomal rearrangement 11.4. Variation in Chromosome Number 11.4.1. Aneuploidy: in human and in plant 11.4.2. Polyploidy: Allopolyploidy and Autopolyploidy	**3**	**4.1.2** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 12. Linkage and recombination in eukaryotes 12.1. Definition Linkage and recombination 12.2. Linkage: complete and incomplete 12.3. Recombination	**3**	**4.1.1** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 13. Human Genetics and Pedigree analysis	**3**	**4.1.1**

13.1. Pedigree analysis for single gene traits 13.1.1. Autosomal dominant trait 13.1.2. Autosomal recessive trait 13.1.3. X-linked (sex-linked) recessive trait 13.1.4. X-linked dominant traits 13.1.5. Y-linked traits 13.2. Most human traits are more complex		**4.1.2** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 14. Population Genetics 14.1. Overview of population genetics and evolutionary 14.1.1. Genetic variability exists at three levels 14.1.2. Both population genetics and evolutionary genetics focus on groups, rather than individual 14.2. The amount of genetic variation in a population can be described through frequencies of alleles and genotypes. 14.3. The Hardy-Weinberg law 14.4. Factors altering gene frequencies	**3**	**4.1.1** **4.1.2** **4.2.1** **4.2.2** **4.3.1** **4.3.2**
Chapter 15. Cytoplasmic Inheritance 15.1. Basic features of organelle genomes and organelle division 15.1.1. Organelles are polyploid, at several different levels 15.1.2. Organelles divide by fission 15.1.3. Organelle DNAs randomly partitioned to daughter cells 15.2. Modern features of organelles reflect their endosymbiotic origin 15.3. Organelle genetic systems 15.4. Rules of Cytoplasmic Inheritance	**3**	**4.1.3** **4.2.1** **4.2.2** **4.3.1** **4.3.2**

7. Teaching method:

- Introducing and explaining.
- Providing supplements, media resources.

8. Duties of student:

Students have to do the following duties:

- Lecture/Class attendance: not allow to be absent more than 20% of lectures.
- Discussion and homeworks: mandatory

9. Assessment of student learning outcomes:

9.1. Assessment

No.	Point components	Rules and Requirement	Weights	Objectives
1	Midterm exam	Tests	40%	Evaluating half course
2	Final exam	Tests	60%	Evaluating whole course

9.2. Grading

- Grading components and final test scores will be marked on a scale of 10 (0 to 10), rounded to one decimal place.

- Subject score is the sum of all the components of the evaluation multiplied by the corresponding weight. The subject score is marked on a scale of 10 and rounded to one decimal place, then is converted to A-B-C-D score and score on a scale of 4 under the academic provisions of the University.

10. Materials:

Materials information	Code number
[1]. Fundamentals Genetics Syllabus	File-BiRDI website
[2]. Pierce, B.A., 2002. Genetics A Conceptual Approach.	**MFN:** 93446
[3]. Robert J. Brooker. 2009. Genetics : Analysis and principles - 3rd ed.. New York: McGraw-Hill. 844 p., 9780072992786.- 576.5/ B872.	**MFN:** 181451
[4]. Jones and Bartlett, 1994. Genetics. Daniel L Hartl.- 3rd.- Boston. 584p., 0 86720 870 8.- 575.1/ H331	**MFN:** 14714

11. Self-study Guide:

Week	Content	Theory (hours)	Practice (hours)	Students' duties
1	**Chapter 1. Introduction to Genetics** 1. Basic concept in Genetics 2. DNA replication 3. Transcription process 4. Genetic code and Translation process	6		Reading in Chapter 1, Chapter 12, Chapter 13, Chapter 15 [Material 2]; in Part I-Chapter 1 and Part III-Chapter 9, Chapter 11 [Material 3]
2	**Chapter 2. Mutations & DNA repair** 1. Consequence of Mutation 2. DNA Repair mechanism 3. Difference: Variation and Mutation	6		Reading Chapter 17 [Material 2]; Part III, Chapter 16 [Material 3]
3	**Chapter 3. Transposable elements** 1. DNA transposons 2. Transposable elements in bacteria 3. Transposon in Maize: Ac/Ds system 4. Retrotransposon only in Eukaryotes	6		Reading Chapter 11 [Material 2]; Part III-Chapter 10; Part IV-Chapter 17 [Material 3];
4	**Chapter 4: Bio-synthetic pathway, Auxotrophy, Complementation** 4.1. Beadle and Tatum's experiment 4.2. Complementary test	6		Reading Part IV-Chapter 13 [Material 3];
5	**Chapter 5. Bacterial Genetics** 1. Bacterial Genome 2. Transformation 3. Conjugation 4. Transduction	6		Reading Chapter 8 [Material 2]; Part III-Chapter 10, Chapter 11, Chapter 12 [Material 3];
6	**Chapter 6. Gene Regulation, Bacterial Lac Operon** 1. Regulated Gene expression 2. Lactose Operon	6		Reading Part IV-Chapter 14 [Material 3];

	3. Regulatory mutations			
7	**Chapter 7. Mitosis and Meiosis** 1. Nuclear division: Mitosis, Meiosis 2. Cell Life Cycle 3. Simple genetic crosses in diploid organisms 4. Dihybrid crosses	6		Reading Chapter 2 [Material 2]; Part II-Chapter 3 [Material 3]
8	**Chapter 8. Quantitative Genetics** 1. Continuous vs Discontinuous traits 2. Tremendous changes in inquantitative traits under selection 4. G x E interaction analysis model	6		Reading Chapter 22 [Material 2]; Part VI-Chapter 25 [Material 3];
9	**Chapter 9. Sex determination and Sex linkage; Sex influenced and sex limited traits** 1. Genetic basis of sex determination 2. Expression of both sexes in one individual 3. Sex determination in animals 4.Chromosomal system for sex determination: XX-XO; ZZ-ZW system. 5. Haplodiploidy in Hymenopteran insects	6		Reading Chapter 4 [Material 2];
10	**Chapter 10. Exceptions to the standard dominance & recessive relationships** 1. Phenotype does not always reflect the genotype: Penetrance and Expressivity 2. Environment may affect phenotype development 3. Genes interacting and altering the phenotypic ratios	6		Reading Chapter 5 [Material 2]; Part II-Chapter 4 [Material 3];
11	**Chapter 11. Chromosome Variation: Rearrangment & Number** 1. Chromosomal structure 2. Changes in chromosome structure 3. Evolutionary impact of chromosomal rearrangement 4. Variation in Chromosome Number	6		Reading Chapter 9 [Material 2]; Part II-Chapter 8 [Material 3];
12	**Chapter 12. Linkage&recombination in eukaryotes** 1. Definition Linkage & recombination 2. Linkage: complete and incomplete 3. Recombination	6		Reading Chapter 7 [Material 2]; Part II-Chapter 5 [Material 3];
13	**Chapter 13. Human Genetics and Pedigree analysis** 1. Autosomal dominant/trecessive trait 2. X-linked (sex-linked) recessive trait	6		Reading Chapter 6, Chapter 21 [Material 2]; Part VI-Chapter 22 [Material 3];

	3. X-linked dominant traits 4. Y-linked traits			
14	**Chapter 14. Population Genetics** 1. Overview of population genetics and evolutionary 2.. The amount of genetic variation in a population can be described through frequencies of alleles and genotypes. 3. The Hardy-Weinberg law 4. Factors altering gene frequencies	6		Reading Chapter 23 [Material 2]; Part IV-Chapter 24; Chapter 26 [Material 3]
15	**Chapter 15. Cytoplasmic Inheritance** 1. Basic features of organelle genomes and organelle division 2. Organelles are polyploid, at several different levels 3. Organelles divide by fission 4. Organelle DNAs randomly partitioned into two daughter cells 5. Modern features of organelles reflect their endosymbiotic origin 6. Organelle genetic systems	6		Reading Chapter 20 [Material 2]; Part II-Chapter 7 [Material 3]

Can Tho, April/25/2014

ON BEHALF OF RECTOR
DEAN/ DIRECTOR

HEAD OF DEPARTMENT