UNIVERSITI TEKNOLOGI MARA

BIO511: GENETICS

Course Name (English)	GENETICS APPROVED
Course Code	BIO511
MQF Credit	4
Course Description	This course will address on the classical genetics, also called the Mendelian or transmission genetics, chromosomal inheritance, modified Mendelian ratios, chromosome mapping, linkage, gene and chromosomal mutations, recombination and populations genetics as well as recent advances in biotechnology that have genetic implications, including the genetic engineering technology. Students will define the vocabulary in genetics and explain the rules of inheritance. Students will apply critical thinking skills in analyzing genetic data and determining mode of inheritance and construct the genetic diagram. The designated lecture session is used to discuss results of genetic crosses leading to its relation to the existing laws. Lecture sessions employ a mixture of lectures and active learning (self and peer discussions). The outcomes shall be assessed through a variety of tools, which include the traditional paper examination, tests, quizzes, assignment, and laboratory repo
Transferable Skills	Knowledge in specific area-content Problem solving and scientific reasoning Managerial
Teaching Methodologies	Lectures, Lab Work, Problem-based Learning
CLO	CLO1 Discuss the mechanisms of gene inheritance and its effect on personal and societal issues. CLO2 Analyse data and problems in genetic studies CLO3 Prepare report on experimental, and interpretative aspects of genetics using written work within the time frame
Pre-Requisite Courses	No course recommendations

Topics
1. Basic Concepts of Genetics 1.1) 1.1: Historical Concepts of Genetics 1.2) 1.1.1: Genetic Timeline 1.3) 1.1.2: Griffith's Experiment 1.4) 1.1.3: Avery's Experiment 1.5) 1.1.4: Hershey and Chase's Experiment 1.6) 1.2: Genetics and society: Classical, Molecular and Population Genetics. Eugenics, Euphenics, and Ethics 1.7) 1.3: Special techniques in genetics that contribute to society (GMOS's, Human Genome Project, Gene Cloning, Gene Testing, Gene Therapy, PCR, DNA Fingerprinting) 1.8) 1.4: The relationship between genes and traits; molecular, cellular, organism and population level.
2. Heredity and Phenotypes 2.1) 2.1: Chromosomes and Cytogenetics: Definition 2.2) 2.1.1: General Features of Chromosomes 2.3) 2.1.2: Terms: Chromatin, Heterochromatin, Euchromatin, Homologous Chromosome, Dyad Chromosome, Monad Chromosome. 2.4) 2.1.3: Assembly of DNA into Chromosomes 2.5) 2.1.4: Giant Chromosomes: Polytene and Lamp Brush Chromosomes 2.6) 2.7) 2.2: Homologous Chromosomes in Diploid: Metacentric, Submetacentric, Acrocentric and Telocentric. 2.8) 2.2.1: Karyotype: Definition, Purposes and Techniques 2.9) 2.2.2: Human Karyotype Nomenclature 2.10) Lab 1: Karyotyping

2.11)
2.12) 2.3: Terms Used in Genetics
2.13) 2.4: Mendelian Genetics (Law of Segregation & Independent Assortment)
2.14) 2.4.1: Testcross, Backcross, Trihybrid cross (Forked-line Method)
2.15) 2.4.2: The Chromosomal Theory of Inheritance
2.16) 2.5: Mendelian Inheritance in Humans (e.g. Cystic fibrosis, albinism, Huntington's disease, achondroplasia, dimple, widow's peak etc)
2.17) Lab 2: Monohybrid Cross
2.18) Lab 3: Dihybrid Cross
2.19) 2.6: Application of Mendelian Principles
2.20) 2.6.1: Probability Theory
2.21) 2.6.2: Sum Rule
2.22) 2.6.3: Product Rule
2.23) 2.6.4: Binomial Expansion
2.24) 2.6.5: Chi-square Test
2.25) Lab 4: Probability
2.26) Lab 5: Chi-square analysis

3. Extension of Mendelian Inheritance
3.1) 3.1. Incomplete Dominance
3.2) 3.2. Codominance
3.3) 3.3. Multiple Alleles
3.4) 3.4. Gene Interaction and Modified Mendelian Ratios (Epistasis)
3.5) 3.5. Pleiotropy, Lethal Alleles, Polygenes (Terms and example)

4. Sex Determination and Sex Linkage
4.1) 4.1. Sex Chromosomes
4.2) 4.2. Sex Determination in Human Beings, Drosophila and Other Animals (The XX, XY, XO, ZW and ZZ system).
4.3) 4.2.1: Temperature Variation and Sex Determination in Reptiles
4.4) 4.3. Sex-Linked Genes (The X-linked and Y-linked): Haemophilia, Colour Blindness, Fragile-X syndrome, Retinitis pigmentosa, etc
4.5) 4.4. Dosage Compensation of X-Linked Genes: The Lyon Hypothesis
4.6) Lab 6: Inactivation of X-linked Genes in Female Mammals
4.7) 4.5. Hyperactivation of X-Linked Genes in Male Drosophila
4.8) 6.6. Sex-Limited and Sex Influenced Traits.

5. Human Pedigrees
5.1) 5.1 Pedigree Analysis in Human Genetics

6. Chromosomal Basis of Inheritance
6.1) 6.1. Variations in chromosome structure
6.2) 6.1.1 Deletion: Cri du chat, Prader-Willi syndrome
6.3) 6.1.2 Translocation: Nonreciprocal intrachromosomal, nonreciprocal interchromosomal, reciprocal interchromosomal, Familial Down Syndrome
6.4) 6.1.3 Duplication: Tandem, Reverse Tandem, Terminal Tandem, Bar allele in Drosophila
6.5) 6.1.4 Inversion: Paracentric, pericentric, Haemophilia A
6.6) 6.2. Variations in chromosome number
6.7) 6.2.1 Aneuploidy: Down syndrome, Patau syndrome, Edwards syndrome, Turner syndrome, Klinefelter syndrome
6.8) 6.2.2 Euploidy: Monoploidy, polyploidy, autopolyploidy, allopolyploidy

7. Linkage, Crossing Over and Genetic Mapping
7.1) 7.1. Linkage, Crossing Over & Genetic
7.2) 7.1.1 Mapping in Eukaryotes: Crossover Value, Three-point crosses, Ordered Asci Analysis
7.3) 7.2. Linkage, Crossing Over & Genetic Mapping in Prokaryotes
7.4) 7.2.1 Definition: Conjugation, Transduction, Transformation
7.5) 7.2.2 Mapping: Conjugation
7.6) Lab 7: Linkage and Crossing over

8. Population Genetics
8.1) 8.1 Terms: Gene pool, genetic variation, microevolution, genetic drift, natural selection, gene flow, mutation, polymorphism (e.g. SNP), monomorphism
8.2) 8.2 Hardy Weinberg Equilibrium, Allelic and Genotypic Frequencies

Assessment Breakdown	%
Continuous Assessment	50.00%
Final Assessment	50.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Lab Exercise	1 Lab report based on combination of several topics	20%	CLO3
Test	Test 1 to cover first half of the lesson plan	15%	CLO1
Test	Test 2 to cover the final half of the lesson plan	15%	CLO2

Reading List	**Recommended Text**	• **McGraw-Hill Science/Engineering/Math; 1 edition (January 21, 2011) 2011, *Concepts of Genetics*, 1st Ed., McGraw-Hill New York [ISBN: 978-007352533]**
	Reference Book Resources	• **Brooker, R.J. 2014, *Genetics: Analysis & Principles.*, 5th Ed., McGraw-Hill New York [ISBN: 978-007352534]**
Article/Paper List	This Course does not have any article/paper resources	
Other References	This Course does not have any other resources	