

**PROGRAM FOR UNDERGRADUATE**  
**ADVANCED EDUCATION PROGRAM – BIOTECHNOLOGY**

Course description

**SHE01001. General Biology (02 credits: 1.5-0.5-4).** Biology is the scientific study of life; Metabolism and Energy Transformation of a Cell; Cell Division and Reproduction; Regulation and adaptation to environment of organism; An Evolutionary Framework for Biology; Microscope and microscope template method; Observation some kinds of prokaryotic cells and eukaryotic cells; Mitosis Observation.

**SHE03022. Nanobiotechnology-principles and applications. (02 credits: 02 – 0 – 04).** The concept about nano technology and nanobiotechnology; the development of nano technology and nanobiotechnology in Vietnam and in the world; classifying and analyzing feature of nanomaterials; methods to produce nanomaterials, advantage and disadvantage of these methods; the application and prospect of nanobiotechnology in cultivation, breeding, aquaculture, biology research, medicine and pharmacy, food technology and environment.

**SHE01002. General Microbiology (Vi sinh vật đại cương). (2: 1,5 - 0,5 - 04)** Introduction to microorganisms; Diversity and ecology of microorganism; Bacteria; Microfungi (Mould and yeast); Microalgae; Virus: Structure and function; Microorganism - Environment Interaction and practices.

**SHE02008. Microbial Ecology (Sinh thái vi sinh vật). (2: 02 - 0- 04)** The microbial habitats; Microbe-Microbe interactions; Interactions between microorganism and plants; Interactions between microorganism and animals; Living together: microbial communities; Microbial processes contributing to biogeochemical cycles; The how of microbial ecology studies.

**SHE03003. Fundamental Immunology (Miễn dịch học cơ sở). (2: 02 - 0- 04)** Cells and tissues of the immune system; Antigens and their receptors; The innate immune response; The adaptive immune response; Abnormalities of the immune system; Infection, immunity, immunopathogenesis; Immunity and the MHC.

**SHE03010. Protein-Enzyme technology (Công nghệ protein – enzyme). (03-0-06)** Enzyme; Protein – enzyme methods; Application of enzymes; Protein-enzyme technology; Protein – enzyme engineering; Immobilized Enzymes

**SHE03011. Protein – enzyme technology lab (Thực hành Công nghệ protein – enzyme). (01: 0-01-02)** Determining activity of enzyme amylase, protease, cellulase using agar diffusion, determining of amylase activity using Maltose standard curve, determining protein concentration using different methods (Biuret, Lowry, Bradford), determining protease activity and gel polyacrylamid electrophoresis.

**SHE03053. Environmental Biotechnology (Công nghệ sinh học môi trường). (2: 02-0-04)** Introduction to environmental biotechnology; Contaminated soils and their biological treatment methods; Accumulation and detoxification of heavy metals by plants and microorganisms; Waste water and biological basis of wastewater treatment methods; Wastewater treatment systems; Organic waste treatment; Decomposition of polycyclic aromatic hydrocarbons (PAHs); Constructed wet lands in wastewater treatment.

**SHE03061. Virology (Virus học). (2: 1,5 - 0,5; 4)** Classification and nomenclature of viruses; Morphology and structure of viruses; Reproduction and translation of viruses; Diversity and

Evolution of viruses; Introduction to plant viruses; Introduction to animal viruses; Bacteriophage and its application in biotechnology; Application of viruses in agriculture..

**SHE04012. Microbial biotechnology (Công nghệ vi sinh) (3, 3: 0: 6).** Microbial Biotechnology: Scope, Techniques, and Applications; Degradations of biomass by fungi and bacteria; Fermentation process, beer and wine productions; Microbial fertilizers; Rhizobacteria and their applications; Microbial biofilm; Microbial applications in Wastewater treatment and remediations of contaminated soils; Prebiotics and probiotics.

**SHE3054. Biosafety (Total credits: 2: lecture: 2, practice: 0, self-learning: 4).** General of biosafety; Laboratory biosafety guidelines; Overview of wide applications of biotechnology and controversies worldwide; Risk assessment and management: principles and procedures; Biosafety assessment of GMOs and their effects to Environment, Human and Animal Health; Tools, methods used in analysis and biosafety assessment of GMOs; International conventions, treaties and agreements on biosafety; Bioethics; Biotechnology and intellectual property rights.

**SHE03008. Genetic Engineering – principles and applications (3 credits: 3-0-6).** General definitions, development history; Introduction to nucleic acid (DNA, RNA); Introduction to gene and genome; Biological systems used in genetic engineering; Enzymes in genetic engineering; DNA, RNA isolation; Nucleic acid electrophoresis; DNA production and cloning techniques; PCR technique; Molecular hybridization techniques; DNA sequencing techniques; Molecular marker techniques; Oriented mutation techniques; RNAi technology and application; Applications of genetic engineering in agriculture; Applications of genetic engineering in medical; Applications of genetic engineering in industry; Applications of genetic engineering in environment.

**SHE03009. Genetic engineering lab. (Thực hành kỹ thuật di truyền). (1:0 – 1 – 2).** DNA extraction; PCR technique; Electrophoresis technique; Cloning techniques; Molecular marker technique; Plant transformation by *Agrobacterium*

**SHE03014. Plant cell and tissue culture technology (3 credits: 3 – 0 - 6).** General introduction; Principles of plant tissue culture technology; Tissue culture medium and conditions; Techniques and applications of plant tissue culture; Discussion on plant tissue culture applied for plant breeding

**SHE03015: Plant cell and tissue culture techniques lab (Total credit 1: lecture 0 – practice 1; self-learning 2; Total credit hours: 15 hours).** organization of a tissue culture laboratory; Medium preparation; Explant sterilization and initiation culture; In vitro propagation; Anther/pollen culture; Embryo culture; Meristem isolation; *In vitro* plant acclimatization techniques

**SHE03065. Plant developmental biology (2 credits: 2 – 0; 4).** Overview of Plant Developmental Biology; Cell lineages and positional information; Embryogenesis; Seedling development; Shoot development; Leaf development; Transition to flowering; Flower development; Development of floral reproductive organs and gametophytes; Pollination and apomixes; Seed and fruit development; Root development; Vascular development.

**SHE02002. Biology of Human and Animal (Sinh học người và động vật). (03: 03 – 0 - 06).** Introduction; cell biology; blood physiology; circulatory physiology; respiratory physiology; Digestive physiology; Matter and energy metabolism regulate body temperature; Physiological

secretion; Endocrine Physiology; Sexual and reproductive physiology; Physiology of sensory organs; Muscle and nerve physiology; Neurophysiology; Physiological high-level neural activity

**SHE03050. Stem Cell Technology (Công nghệ tế bào gốc). (02: 02 – 0 – 04).** General stem cell; Embryonic stem cell; Adult stem cells; Stem cell therapy; Stem cell cryopreservation

**SHE03052. Biotechnology in Animal Breeding (CNSH trong chọn tạo giống động vật). (02: 02 – 0)** Introduction; The concepts and principles of animal breeding; Traditional technology in animal breeding; Genetic engineering in Animal breeding; Transgenic animal technology.

**SHE03056. Seminar ( 01: 01 – 0 – 02)** Select topic, collect and evaluate the scientific documents; Analyse and select the approaches; Built the presentation; Speaking ability and organize a seminar.

**SHE03060. Molecular Diagnostics and Gene Therapy (Chẩn đoán phân tử và liệu pháp gen). (02: 02 – 0 - 04).** Basic concepts in diagnosis; Molecular Diagnostic Technology; Application of diagnosis; Basic concepts in gene therapy; Gene therapy; The persistence of therapeutic gene in cell and gene targeting.

**SHE03064. Developmental Biology of Animal (Sinh học phát triển động vật) (02: lecture 02 -0 - 04).** Development; Gametogenesis; Fertilization; Early Embryonic Development.

**SHE04006. Animal Cell Technology. (Công nghệ tế bào động vật). (03TC: 03 – 0 - 6).** Scientific background, great achievements of animal cell technology; Organizing the laboratory of animal cell culture; Animal cell culture technology; Three dimensions animal cell culture technology and other culture systems; Related techniques in culture of animal cells; Artificial Insemination Technology; Embryo Technology; Applications of animal cell technology

**SHE04007. Animal Cell Technology Laboratory (Thực hành công nghệ tế bào động vật). (01: 0 – 01 - 02).** Basic techniques in preparation, preservation of media and equipment in animal laboratory; Collection, manipulation of follicular oocytes from mammalian ovary; *In vitro* culture and animal cell cryopreservation; Evaluation of mammalian semen

**SHE03001. English for biotechnology (Tiếng Anh chuyên ngành) (4TC: 4-0-8).** This course consists of 15 units: Introduction to Biotechnology; Biology and the classification of organism; The cell; Ecology; Genetics; Biodiversity and evolution; Bioinformatics; Immunology; Biochemistry; Microbiology; Fermentation; Genetic Engineering; Cell and tissue culture; Animal cell technology; Mushroom Biotechnology

**SHE03057. Current topics in biotechnology (Chuyên đề trong Công nghệ sinh học) (2TC: 2-0; 4).** This course consists of 5 mains topics: New achievements and techniques in plant biotechnology; New achievements and techniques in animal biotechnology; New achievements and techniques in microbial biotechnology; New achievements and techniques in food biotechnology; New achievements and techniques in nanotechnology.

**SHE02005. Molecular Bilology I (Sinh học phân tử I) (2 credits: 2 – 0 – 4).** History of molecular biology; Macromolecules: Nucleic acid and Protein; Sturcture of gene and genome ; DNA replication; DNA mutation and repair; Gene transcription in eukaryote; Genetic code and translation.

**SHE02006. Practice of Molecular Bilology I (Thực hành sinh học phân tử 1) (1 credit: 0 – 1 – 2).** Buiding the double helix structure of DNA molecule; Determination of the

denaturation, renaturation and the complementary annealing of DNA molecule; Study the DNA repetitive elements in genome; Analysis of mutation in haemoglobin gene in sickle cell disease

**SHE03002. Evolution and biodiversity (3 credits: lecture 3 – practice 0 – self-learning 6; total credit hours: 45).** The basic concepts; Darwin's theory of evolution; The origin of life and the development of the earth; Evolution of genomes, genes and chromosomes; Population and evolutionary factors; Species and the mechanism of speciation; Biodiversity; Impacts on Biodiversity; Biodiversity in the world, in Vietnam and conservation issues; Conservation of genetic resources.

**SHE03004 Molecular biology II (3 credits: lecture 3 – practice 0 – self-learning 6; total credit hours: 45).** The basic concepts; Darwin's theory of evolution; The origin of life and the development of the earth; Evolution of genomes, genes and chromosomes; Population and evolutionary factors; Species and the mechanism of speciation; Biodiversity; Impacts on Biodiversity; Biodiversity in the world, in Vietnam and conservation issues; Conservation of genetic resources

**SHE03005. Applied bioinformatic (Tin sinh học ứng dụng) (3 credits: 2 – 1 – 6).** Introduction to Bioinformatics; Biological basis of bioinformatics; Internet and assisted tools for searching study materials; Biological databases; Sequencing and sequence submission; Genome browsers; Get familiar with biological database analysis tools; Datamining and data analysis; Softwares for biological data analysis.

**SHE03051 Biotechnology in plant breeding (2 credits: lecture 2 – practice 0 – self-learning 4; total credit hours: 30).** Concept and the role of genetic resource in conservation and breeding. The technology in plant breeding: tissue culture, genetic engineering, DNA markers. Method and principle of breeding: backcross, pyramiding, pedigree. Application of biotechnology in new crop registration and GM crop monitoring

**SHE03068. Practice of Biotechnology in plant breeding (1 credits: lecture 0 – practice 1 – self-learning 2; total credit hours: 15).** Characterizing and testing seed, crossing method in self-pollination and cross-pollination. Tissue culture for anther and ovules culture. Detection of target gene and GM crop by DNA marker

**SHE02004. General Genetics (3 credits: lecture 3 – practice 0 – self-learning 6; total credit hours: 45).** Genetics - the center of biology; Mendelian Genetics; Interaction of genes and environment; Genetics of chromosome and genetic links; The molecular basis of heredity (structure, gene expression and regulation); Gene mutations, chromosome, genome variation and corrective; Genetics of microorganisms (viruses, bacteria, fungi and algae); Quantitative genetics, heterosis and cytoplasmic genetics; Developmental genetics in individual and evolution; Application of genetics; Human genetics and biomedical applications

**SHE04001. Professional Internship 1 (Thực tập nghề 1) (5 credits: 0 - 5 – 10).** Make a proposal of the internship (urgency, purpose, requirements, research content, expected results, implementation plan); Report of internship; Contact place practice; Internships; Write and report internship results

**SHE04002. Professional Internship 2 (Thực tập nghề nghiệp 2) (8 credits: 0 - 8 – 16)**

Make a proposal of the internship (urgency, purpose, requirements, research content, expected results, implementation plan); Report of internship; Contact place practice; Internships; Write and report internship results

**SHE04999. Graduation thesis (Khóa luận tốt nghiệp) (10 credits: 0 - 10 – 20)** Writing proposal of the thesis (urgency, purpose, requirements, research content, expected results,

implementation plan); Issue the proposal of the subject; To carry out research contents; Mid-term report in subject; Writing and submitting graduation theses; Protect the graduation thesis.