

**Program:** Master of Science Program in Biomedical Sciences

**Degree:** Master of Science (Biomedical Sciences)

**Study Plan:**

**1) Research Program (Scheme A 1)**

Year	First Trimester	Cr	Second Trimester	Cr	Third Trimester	Cr
Year 1	115799 Thesis	4	115799 Thesis	6	115799 Thesis	6
	115791 Seminar in Biomedical Sciences I		115792 Seminar in Biomedical Sciences II		115793 Seminar in Biomedical Sciences III	
	<b>Total</b>	<b>4</b>	<b>Total</b>	<b>6</b>	<b>Total</b>	<b>6</b>
Year 2	115799 Thesis	10	115799 Thesis	10	115799 Thesis	10
	<b>Total</b>	<b>10</b>	<b>Total</b>	<b>10</b>	<b>Total</b>	<b>10</b>

**2) Regular Program (Scheme A 2)**

Year	First Trimester	Cr	Second Trimester	Cr	Third Trimester	Cr
Year 1	115603 Care and Use of Laboratory Animals	2	115701 Cellular and Molecular Biology	4	115602 Research Methods and Statistics in Biomedical Sciences	4
	115604 Fundamental Biomedical Sciences I and/or	4	115604 Fundamental Biomedical Sciences I and/or	4	115604 Fundamental Biomedical Sciences I and/or	4
	115605 Fundamental Biomedical Sciences II	4	115605 Fundamental Biomedical Sciences II and/or	4	115605 Fundamental Biomedical Sciences II and/or	4
	Major Course	2-4	115702 Molecular and Cellular Research Techniques	2	115703 Biomedical Laboratory Techniques	2
	Elective Course	2-4	Major Course	2-4	Major Course	2-4
					115791 Seminar in Biomedical Sciences I	1
	<b>Total</b>	<b>6/18</b>	<b>Total</b>	<b>8/18</b>	<b>Total</b>	<b>9/19</b>
Year 2	Major Course and/or	2-4	115793 Seminar in Biomedical Sciences III	1	115798 Thesis	7
	Elective Course	2-4	115798 Thesis	6		
	115792 Seminar in Biomedical Sciences II	1				
	115798 Thesis	3				
	<b>Total</b>	<b>6/12</b>	<b>Total</b>	<b>7</b>	<b>Total</b>	<b>7</b>

**Program:** Master of Science Program in Biomedical Sciences

**Degree:** Master of Science (Biomedical Sciences)

**Course Description:**

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
<b>Core Courses</b>				
115602 Research Methods and Statistics in Biomedical Sciences	4(4-0-12)	None	Key concepts in research methodology, including research definition, research category, research methods, research ethic, and research proposal writing. This course also focuses on choosing the appropriate statistics for biomedical research. Basic statistics, such as descriptive statistics, inference statistics and non-parametric statistics, reviewing prior to applications in biomedical research. Discussion in using computer software for statistical analysis.	<ol style="list-style-type: none"> <li>1. understand concepts in research methodology</li> <li>2. write a research proposal</li> <li>3. choose the appropriate statistics for biomedical research</li> <li>4. use computer software for statistical analysis</li> </ol>
115603 Care and Use of Laboratory Animals	2(1-3-4)	None	This course covers the general information of experimental animal science, regulation, ethics, alternatives to use of animals, properties of the animals themselves, anatomy and physiology of experimental animal science, practice and techniques with animal, external factors that influence experiments, plan and animal design of studies	<ol style="list-style-type: none"> <li>1. describe about basic knowledge in animal ethics that emphasizes animal laboratory practice, animal welfare and handling techniques</li> <li>2. explain basic knowledge in anatomy and physiology that emphasizes principles of anesthesia, chemical injection, euthanasia, and collect tissue samples</li> <li>3. know how to do anesthesia, chemical injection euthanasia and collect tissue samples</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115604 Fundamental Biomedical Sciences I	4(4-0-12)	None	Integration of knowledge in anatomy, physiology, introduction to pharmacology, pharmacokinetics and pharmacodynamics. Emphasize on knowledge in biomedical researches.	<ol style="list-style-type: none"> <li>1. integrate the knowledge in anatomy, physiology and pharmacology</li> <li>2. utilize the knowledge in biomedical researches</li> </ol>
115605 Fundamental Biomedical Sciences II	4(4-0-12)	115604 Fundamental Biomedical Sciences I	Integration of knowledge in immunology, microbiology, parasitology, pathology and antimicrobial drugs. Emphasize on knowledge in biomedical researches.	<ol style="list-style-type: none"> <li>1. integrate the knowledge in immunology, microbiology, parasitology, pathology and antimicrobial drugs</li> <li>2. utilize the knowledge in biomedical researches</li> </ol>
115701 Cellular and Molecular Biology	4(4-0-12)	104650 Cell Biology or Consent of the School	Studies of structures and functions of cells at molecular levels, including recent research advances in cell organelles, cell processes and applications of cell biology. Presentations and reports on recent advanced research on cell molecular biology.	<ol style="list-style-type: none"> <li>1. demonstrate knowledge of how cellular and molecular biology is used to elucidate the function of cells and their organization into tissues</li> <li>2. apply the knowledge of cellular and molecular biology to research project</li> <li>3. present advanced knowledge in the specialized fields of molecular and cell biology</li> </ol>
115702 Molecular and Cellular Research Techniques	2(1-3-4)	None	Studies of necessary skills for theoretical and laboratory research techniques, such as immunology and microbiology, cell and tissue culture, molecular biology, stem cells and genes.	<ol style="list-style-type: none"> <li>1. describe the basic technique in molecular biology</li> <li>2. have skills in using information technology for searching data from bioinformatics data base</li> <li>3. able to design and carry out experiment to obtain recombinant DNA</li> <li>4. have skills in animal tissue culture</li> <li>5. analyze and detect protein</li> <li>6. analyze and conclude the results</li> </ol>

<b>Courses</b>	<b>Credit (Lect.-Lab- Self stud.)</b>	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115703 Biomedical Laboratory Techniques	2(1-3-4)	None	Studies of necessary skills of theoretical and laboratory biomedical research techniques, such as laboratory animals, physiology and pharmacology evaluation, histological techniques, microscopes and chromatography.	1. know and can explain about basic knowledge of theoretical and laboratory biomedical research techniques both in vitro and in vivo, data analysis, report the result, and discuss the result
<b>Major Courses (Anatomy)</b>				
115611 Human Developmental Anatomy	4(4-0-12)	None	Gametogenesis, fertilization, development of organ systems starting from fertilization until complete term of gestation, relationship between mother and embryo (fetus), and congenital anomalies	1. know gametogenesis and fertilization 2. explain development of organ systems starting from fertilization until complete term of gestation 3. know relationship between the mother and the embryo (fetus), and congenital anomalies
115612 Microscopic Anatomy	4(3-3-10)	None	Studies of structures and functions of normal tissue including laboratory techniques used for tissue staining in order to observe under light microscope and electron microscope.	1. explain structures and functions of human normal tissue 2. know laboratory techniques used for tissue staining in order to observe under light microscope and electron microscope
115613 Microscopic Techniques for Tissue	4(2-6-8)	None	Specimen preparation of animal tissues for light, scanning and transmission electron microscopies (SEM and TEM) using conventional and special techniques, including fixative preparation, tissue processing, embedding, section, staining, and observation of structures and organelles using each microscopy.	1. explain and able to prepare animal tissues for light microscopy 2. explain and able to prepare animal tissues for scanning and transmission electron microscopies (SEM and TEM)

<b>Courses</b>	<b>Credit (Lect.-Lab- Self stud.)</b>	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115614 Neuroanatomy	4(3-3-10)	None	Study of the basic structures of the nervous system including organization of the nervous system, neuron, nervous tissue, organs of the nervous system, and special sense organs. Study of function of each structure and function as the whole system.	<ol style="list-style-type: none"> <li>1. explain organization of the nervous system</li> <li>2. explain gross anatomy and microanatomy of the organs of the nervous system and special sense organs</li> <li>3. explain functions of organs of the nervous system and special sense organs</li> </ol>
115615 Human Anatomy	4(3-3-10)	None	Study the basic principles of structures, functions, and types of cells, tissues, and organs of the body systems such as skeletal system, muscular system, special sense organs, nervous system, respiratory system, cardiovascular system, digestive system , urinary system, reproductive system, endocrine system, and relationship between structures and functions of all related systems	<ol style="list-style-type: none"> <li>1. explain basic knowledge in anatomy by emphasizing identify and specify of the structures and principles of functions in body systems</li> <li>2. describe laboratory practice in relation to structure and relationship between organs in the body systems such as skeletal system, muscular system, special sense organs, nervous system, respiratory system, cardiovascular system, digestive system , urinary system, reproductive system, endocrine system, and relationship between structures and functions of all related systems</li> </ol>
115616 Gross Anatomy I	4(3-3-10)	None	Study the basic principles of morphology, structures, location, relationship between organs and major functions of organs and components of body systems in back, pectoral region, axillary region, upper and lower extremities, emphasizing the applying knowledge of gross anatomy in the context, in which it will be used in the research field of biomedical sciences	<ol style="list-style-type: none"> <li>1. identify and specify the structures in back, pectoral region, axillary region, upper and lower extremities and explain basic knowledge of gross anatomy, including principles of functions in body systems</li> <li>2. know and apply the basic knowledge of gross anatomy in the research field of biomedical sciences</li> </ol>

<b>Courses</b>	<b>Credit (Lect.-Lab- Self stud.)</b>	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115617 Gross Anatomy II	4(3-3-10)	None	Study the basic principles of structures, morphology, location, relationship between organs and major functions of organs and components of body systems in head, neck, abdomens and pelvis that emphasize the applying the knowledge of gross anatomy	<ol style="list-style-type: none"> <li>1. explain basic knowledge in gross anatomy by emphasizing identify and specify of the structures and principles of functions in body systems focusing on head, neck, abdomens and pelvis</li> <li>2. know and apply the basic knowledge of gross anatomy in health sciences or biomedical sciences</li> </ol>
115811 Advanced Neuroanatomy	4(3-3-10)	115614 Neuroanatomy or Consent of the School	Study of structures and functions of organs of the nervous system including spinal cord, cerebrum, cerebellum, brainstem, limbic system, basal ganglia, diencephalon, blood supply of the nervous system, special senses, nuclei and ganglia, tracts, and relationships between functions and pathologies of structures of the nervous system.	<ol style="list-style-type: none"> <li>1. explain gross anatomy and microanatomy of structures of the nervous system</li> <li>2. explain functions of organs of the nervous system</li> <li>3. explain basic pathologies of structures of the nervous system</li> </ol>
<b>Major Courses (Physiology)</b>				
115621 Integrated Physiology	4(4-0-12)	None	Integration of knowledge about physiological principles and control of various systems, including nervous, endocrine, musculoskeletal, cardiovascular, respiratory, gastrointestinal and reproductive systems. Emphasis given on utilization of knowledge in research topics, daily life, sport science and medicine.	<ol style="list-style-type: none"> <li>1. integrate knowledge about physiological principles and control of various systems</li> <li>2. utilize knowledge in research topics, daily life, sports science and medicine</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115622 Experimental Physiology	4(2-6-8)	None	Measurements of bioelectrical potentials, concentration of substances, flows and behaviors. Techniques in animal restraint and surgery, respiratory physiology, cardiovascular physiology, renal physiology, alimentary physiology, neurophysiology, reproductive physiology, endocrine physiology, and physiology of exercise.	<ol style="list-style-type: none"> <li>1. describe laboratory practice in relation to functions and mechanisms in body systems</li> <li>2. know how to measure physiology laboratory</li> </ol>
115711 Reproductive System in Biomedical Sciences	4(4-0-12)	None	Male and female reproductive anatomy, development of reproductive system, early stages of sexual development, fertilization, pregnancy, parturition, control of reproductive system, and advanced techniques for family planning, problems of sexuality and fertility. New technology for studying and researching in reproduction, in vitro fertilization, embryonic transfer. Phenomena and behaviors in reproduction.	<ol style="list-style-type: none"> <li>1. integrate knowledge about physiological in reproductive system</li> <li>2. utilize knowledge in research topics, daily life and medicine</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115712 Muscular System in Biomedical Sciences	4(4-0-12)	None	Anatomy and developmental biology of muscles, characteristics and functions of various types of muscle, relationship of membrane potential and contractile mechanism, metabolism of muscles, regulation of muscle function, some pathophysiology of muscles. Related research techniques used in muscular physiology.	<ol style="list-style-type: none"> <li>1. integrate knowledge about physiology on muscular system</li> <li>2. utilize knowledge in research topics, daily life, sports science and medicine</li> </ol>
115721 Exercise Physiology	4(4-0-12)	None	Function of body during exercises and adaptations that occurred in response to changes caused by exercise. Knowledge and application of scientific principles are necessary to develop peak performance in athletes and maintain health and fitness in the general population improving life.	<ol style="list-style-type: none"> <li>1. integrate knowledge about exercise physiology on various system</li> <li>2. utilize knowledge in research topics, daily life, sports science and medicine</li> </ol>
115722 Advanced Cellular and Molecular Physiology	4(4-0-12)	115621 Integrated Physiology	Advanced concepts in physicochemical properties of the cell, cell membrane and ion channels, mechanisms of membrane transport, controls of cellular functions, techniques and methods of studying cell properties and functions.	<ol style="list-style-type: none"> <li>1. integrate knowledge about advanced cellular and molecular physiology</li> <li>2. utilize knowledge in research topics, daily life, sports science and medicine</li> </ol>
115723 Neurochemistry	4(4-0-12)	None	Biochemistry of neuron, molecular composition of structures and various functions of neurons and neuroglia. Chemical substances and hormones in nervous system involved in behavior in various conditions.	<ol style="list-style-type: none"> <li>1. integrate knowledge about neurochemistry and control of various systems</li> <li>2. utilize knowledge in research topics, daily life, sports science and medicine</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115724 Cardiovascular System in Biomedical Sciences	4(4-0-12)	None	Functional properties of cardiac muscle, biochemical aspects of cardiac muscle, dynamics of the heart beat and electrocardiograph, cardiac output and control of cardiac output, systemic circulation and thermodynamics, systolic, diastolic and mean arterial blood pressure, circulatory shock, congestive heart failure, hypotension, and hypertension.	<ol style="list-style-type: none"> <li>1. integrate knowledge about anatomy, pathophysiology and pharmacology in cardiovascular system</li> <li>2. utilize knowledge in research topics, daily life, sports science and medicine</li> </ol>
115725 Endocrine System in Biomedical Sciences	4(4-0-12)	None	Comprehensive study of the endocrine system, anatomy of the endocrine system, role of the endocrine system in maintaining homeostasis, and the relationship between the nervous and endocrine systems. Pathological diseases associated with endocrine imbalance and related drugs for treatments.	<ol style="list-style-type: none"> <li>1. integrate knowledge about anatomy, pathophysiology and pharmacology in endocrine system and control of various systems</li> <li>2. utilize knowledge in research topics, daily life, sports science and medicine</li> </ol>
115726 Renal System in Biomedical Sciences	4(4-0-12)	None	Dynamics of kidney via renal mechanism for concentrating and diluting urine, renal regulation of ECF volume and of acid-base balance, diuresis, micturition, and renal diseases.	<ol style="list-style-type: none"> <li>1. integrate knowledge about anatomy, pathophysiology and pharmacology in cardiovascular system</li> <li>2. utilize knowledge in research topics, daily life, sports science and medicine</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115727 Gastrointestinal System and Metabolism in Biomedical Sciences	4(4-0-12)	None	Ontogeny and anatomy, blood and lymphatic circulation, enteric nervous system, hormone, immune system of the alimentary tract, and enteric bacteria and metabolic process focusing on the application in medicine. Pharmacology of gastrointestinal drugs. Recent mechanism of drugs induced gastrointestinal disorders.	1. integrate knowledge about anatomy, pathophysiology and pharmacology in gastrointestinal system and metabolism 2. utilize knowledge in research topics, daily life, sports science and medicine
115728 Aging Physiology	4(4-0-12)	None	Physiological changes in systemic and organismic aging. Prevention and rehabilitation.	1. integrate knowledge about aging physiology and control of various system 2. utilize knowledge in research topics, daily life, sports science and medicine
115729 Respiratory System in Biomedical Sciences	4(4-0-12)	None	Principle of respiration physiology, pulmonary mechanisms, distribution of gases and gas exchange in lungs and tissues, transport of oxygen and carbon dioxide, ventilation-perfusion relationships, control of respiration, respiration in unusual environments, and spirometry.	1. integrate knowledge about anatomy, pathophysiology and pharmacology in respiratory system 2. utilize knowledge in research topics, daily life, sports science and medicine
115821 Cellular and Molecular Neuroscience	4(4-0-12)	None	Cellular and molecular basis of nervous system structure and function. Synapse formation, synaptic transmission, maintenance and plasticity of synaptic connections with an emphasis on cellular and molecular mechanisms underlying these events.	1. integrate knowledge about cellular and molecular neuroscience and control of various systems 2. utilize knowledge in research topics, daily life, sports science and medicine

<b>Courses</b>	<b>Credit (Lect.-Lab- Self stud.)</b>	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115827 Systemic Neuroscience	4(4-0-12)	None	Contemporary understanding of structures and functions of neural system at systemic level such as sensory, motor, autonomic, limbic and neuroendocrine systems.	<ol style="list-style-type: none"> <li>1. integrate knowledge about systemic neuroscience and control of various systems</li> <li>2. utilize knowledge in research topics, daily life, sports science and medicine</li> </ol>
115828 Advanced Topics in Physiology	4(4-0-12)	115621 Integrated Physiology	Lecture and discussion on advanced topics or recent developments in physiology. (Topics will be announced when opened)	<ol style="list-style-type: none"> <li>1. integrate knowledge about advanced physiology and control of various systems</li> <li>2. utilize knowledge in research topics, daily life, sports science and medicine</li> </ol>
104640 Molecular Genetics	4(4-0-8)	104203 Genetics or Consent of the School	Structure, replication and recombination of DNA, mutations as tools for genetic analysis, gene expression and controls of gene expression, genome and proteome, essential techniques of molecular genetics.	<ol style="list-style-type: none"> <li>1. explain meaning and function of gene, genome and chromosome</li> <li>2. explain mechanisms of how genetic information is used in controlling traits of organisms</li> <li>3. explain molecular genetic mechanisms that affect gene expression</li> <li>4. explain roles of genetic control at the molecular level in development of animal models</li> <li>5. explain molecular genetic mechanisms that have effects on evolution</li> <li>6. provide laboratory techniques for molecular genetic studies</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115732 Cell and Molecular Biology of Cancer	4(4-0-12)	None	History and epidemiology of cancer, characteristics and behavior of cancer cells, principles of transformation, viral and cellular oncogenes, tumor suppressor genes, cell cycle and its control, proliferative signal transductions, genetics of cancer, apoptosis, multistage carcinogenesis, tumor immunology, therapeutic approach of cancer, and recent advanced research in cancer biology.	1. know and explain the principles and theory of cell and molecular biology of cancer 2. integrate knowledge and principles of cell biology and biology of cancer cells
115735 Cell Proliferation and Apoptosis	4(4-0-12)	115701 Cellular and Molecular Biology or Consent of the School	General features of cell proliferation and apoptosis, matters of life and death and immunogeneticity of apoptotic cells. Emphasis on apoptosis in action, molecular pathway of apoptosis, and approaches for studying apoptosis.	1. know and explain the principles and theory of cell proliferation and apoptosis 2. apply the knowledge of cell proliferation and apoptosis to scientific research project
115831 Molecular Biology	4(4-0-12)	104640 Molecular genetics or Consent of the School	Studies of molecular biology of proteins, nucleic acids, and molecular genetics, characterization and functions of macromolecules in cells, gene expression and regulation in prokaryotes and eukaryotes, and DNA-protein interactions.	1. explain the principles and theory of molecular biology 2. utilize knowledge of molecular biology to explain the relationship of DNA, protein, and cell phenotype
<b>Major Courses (Host/Pathogen Interactions)</b>				

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115742 Infectious Immunology	4(4-0-12)	115744 Immunology in Biomedical Sciences and 115743 Microbiology in Biomedical Sciences or Consent of the School	Immune response against bacterial, rickettsiae, viral, fungal and parasitic infections.	<ol style="list-style-type: none"> <li>1. understand the immunological responses to infections from pathogenic bacteria, viruses, fungi, and parasites</li> <li>2. apply new technologies used to examine the immunological reactions to infections from variety of pathogenic microorganisms</li> </ol>
115743 Microbiology in Biomedical Sciences	4(4-0-12)	104201 Microbiology or equivalent or Consent of the School	Studies in details on recent medically important microorganisms including bacteria, virus and fungi, new knowledge or changing in pathogenesis, drug resistance, modes of transmission and carriers. Emergent technologies for laboratory diagnosis and vaccine development.	<ol style="list-style-type: none"> <li>1. describe in details of the knowledge of medically important microorganisms including bacteria, viruses and fungi, especially the up-to-date knowledge</li> <li>2. evaluate the trends of infectious diseases, antimicrobial resistance patterns, transmission, and carriers</li> <li>3. apply newly developed methods used to diagnose the causative microorganisms of infectious diseases and study microbiology</li> </ol>
115744 Immunology in Biomedical Sciences	4(4-0-12)	104201 Microbiology or equivalent or Consent of the School	Studies in details about immunological system and mechanisms for protection from microbes, immune response to foreign substances, immunological tests, mechanisms of tissue damages, hypersensitivity, tumor, immunological disorder, autoimmunity, immunization, new technologies, such as nanomedicine and applied knowledge for diagnosis and treatments with immunotherapies.	<ol style="list-style-type: none"> <li>1. understand the immune system and protective defenses from foreign particles and pathogens</li> <li>2. apply new technologies used to examine the immunological reactions</li> <li>3. analyze the mechanisms of tissue destruction, hypersensitivity, and diseases caused by immunological defects</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115751 Experimental Parasitology	2(1-3-4)	115753 Parasitology in Biomedical Sciences or study concurrently	This course deals with experimental methods and laboratory techniques for parasitological researches. For example, morphological and important characteristics of parasites, diagnostic methods of major parasitic diseases, and related laboratory techniques, also the experimental skills and study abilities.	<ol style="list-style-type: none"> <li>1. know appropriate method for detection of key parasites</li> <li>2. accurately and precisely diagnose parasites from specimen</li> <li>3. have skill in laboratory and know various research techniques in parasitology</li> </ol>
115752 Host-Parasite Relationships and Interactions	4(4-0-12)	115753 Parasitology in Biomedical Sciences	This course emphasizes on the study of principal factors which affect levels of parasitic infection and treatment of infections in humans. Integration and management of host-parasite relationships and interactions in terms of transmission and distribution, population dynamics, environmental management, behavior, immune responses, pathology, and pharmacology to decrease parasitic infection.	<ol style="list-style-type: none"> <li>1. know about important factors essential for level of parasitic infection and relationship of parasite and host</li> <li>2. know about population dynamics and environmental management which are imperative for infection or prevention and control</li> <li>3. know about human behavior influenced parasitic infection and immune response to parasite in human body</li> </ol>
115753 Parasitology in Biomedical Sciences	4(4-0-12)	None	Studies host-parasite relationships especially important protozoa and helminthes. Morphology, life cycle, epidemiology, mechanism of infection, mode of transmission, carrier, and pathogenesis will be studied. Also, guideline for diagnosis and treatment of parasitic diseases. Surveillance and emerging diseases will be included.	<ol style="list-style-type: none"> <li>1. know about host-parasite relationship and importance of parasites in Biomedical Sciences</li> <li>2. know about protozoa and helminthes that cause major parasitic diseases in terms of basic biology, as well as, medical sciences and public health</li> <li>3. know about emerging diseases related to important parasites and influenced human population</li> </ol>

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
<b>Major Courses (Pathobiology)</b>				
115761 Molecular Pathology	4(4-0-12)	None	Studies of regulatory mechanisms and pathogenesis of diseases. Cell and cell interaction, cell migration, molecular signal transduction and genetic code participating in normal and pathological processes during illness. In addition, presentation of evidence-based recent relevant finding from literatures and cell injury.	1. interconnect the knowledge between mechanism and pathology at cellular and molecular level 2. apply the knowledge into their research works pertinent to medicine and daily life
115762 Molecular Pathology Laboratory	1(0-3-1)	None	Laboratory examinations of mechanism and/or pathogenesis of diseases. Students will perform laboratories involved mechanism and/or pathogenesis or normal status of cells and molecular targets. Then, correlate those findings with normal functions of such molecules at normal and abnormal stages.	1. perform essential laboratory methods used in pathology at cellular and molecular level 2. apply the pathological investigations into their research works
115763 Developmental Biology and Molecular Genetics	4(4-0-12)	None	Studies of genes and their regulations during organogenesis. Class will consist of a combination of lecture and presentation emphasized on hepatogenesis and molecular mechanisms regulating the processes found in classical and contemporary literatures.	1. explain the molecular control during organogenesis 2. apply the knowledge into their research works pertinent to medicine and daily life

<b>Courses</b>	<b>Credit</b> (Lect.-Lab-Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115764 Molecular Pathology of Tumor and Stem Cells	4(4-0-12)	None	Pathological processes at molecular level of tumors and stem cells, focusing on molecular aberrant underlining in tumorigenesis and stem cell tumor compared with regular stem cells.	1. explain the difference between stem cells and tumor stem cells 2. apply the knowledge into their research works
115766 Principles of Pathology	2(2-0-6)	None	Studies about principles of pathology, particularly relevant to the understanding response to injury (at cellular and tissue levels), mechanisms of cell injury and pathobiology of neoplasms.	1. know the principle of pathology at cellular and tissue level 2. apply the knowledge into their research works
<b>Major Courses (Pharmacology and Toxicology)</b>				
115670 Antioxidants for Health and Beauty	4(4-0-12)	None	Free radicals formation in cells and tissues, types and sources of antioxidant nutrients, protective mechanisms of antioxidants against free radical damages, antioxidant nutrients and disease prevention/alleviation, antioxidants in cosmetics and beauty, and recent researches on antioxidants in biomedicine.	know and can explain about basic knowledge of types and sources of antioxidant, protective mechanisms of antioxidants against free radical damages, antioxidants in cosmetics and beauty, and recent researches on antioxidants in biomedicine
115671 Free Radicals in Biology and Medicine	4(4-0-12)	None	Chemistry of biologically free radicals, detrimental and beneficial effects of reactive oxygen species and antioxidant defenses in the body, mechanisms of oxidative damages to cellular targets, cellular responses to oxidative stress, roles of free radicals in health and diseases, and antioxidants in protection and therapy of oxidative diseases.	know and can explain about basic knowledge of the chemistry of biologically free radicals, roles and mechanisms of free radicals in health and diseases, and antioxidants in protection and therapy of oxidative diseases

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115672 Free Radicals in Toxicology	4(4-0-12)	None	Contribution of free radicals and related reactive oxygen species to toxicology, free radical metabolites of toxicants and drugs as sources of oxidative stress, toxicity, target organs, molecular and cellular mechanisms of prooxidant toxicants, and recent researches on free radicals and oxidative stress triggered by toxicants.	know and can explain about basic knowledge of free radicals and related reactive oxygen species to toxicology, molecular and cellular mechanisms of prooxidant toxicants, and recent researches on free radicals and oxidative stress triggered by toxicants
115673 Cancer Chemotherapy	4(4-0-12)	None	Overview and background of cancer and anticancer therapy, pathogenesis of cancer, general principles of action of cytotoxic anticancer drugs, drugs used in cancer chemotherapy, resistance to anticancer drugs, treatment schedules, techniques for dealing with emesis and myelosuppression, current researches in anticancer agents, possible future strategies for cancer chemotherapy.	know and can explain about basic knowledge of cancer and anticancer therapy, pathogenesis of cancer, general principles of action of cytotoxic anticancer drugs, current researches in anticancer agents, possible future strategies for cancer chemotherapy
115770 Molecular Mechanisms of Drug Action	4(4-0-12)	None	Chemical and biological concepts underling pharmacology essential to understanding this science, including drug actions and reactions; as emphasis of its important place within the biomedical sciences.	1. know chemical and biological concepts underling molecular pharmacology of drug actions 2. explain other reactions between drug and body systems

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115771 Neuropharmacology	4(4-0-12)	None	Cellular, functional properties of various neuronal systems and of drugs affecting these systems. Emphasis is given to effects and functions of various neurotransmitter substances on different neuronal pathways, interactions between these endogenous substances and drugs or exogenous chemicals, effects of drugs on normal or abnormal behaviors, drugs used in affective disorders.	know and can explain about basic knowledge of cellular, functional properties of various neuronal systems and drugs and neurotransmitter substances affecting these systems. The effects of drugs on normal or abnormal behaviours, drugs used in affective disorders
115772 Chemotherapy Pharmacology	4(4-0-12)	None	Principles of chemotherapy, such as molecular principles of chemotherapy, resistance to antibiotics, antibacterials, antivirals, antifungals, antiprotozoals, anthelmintics, antiseptics and disinfectants, cancer chemotherapy, vaccines and toxoids.	know and can explain about basic knowledge of molecular principles of chemotherapy, resistance to antibiotics, antibacterials, antivirals, antifungals, antiprotozoals, anthelmintics, antiseptics and disinfectants

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
115773 Advanced Hormonal Pharmacology	4(4-0-12)	None	Current concepts in pharmacology of hormones that produced from the endocrine system and use of these hormones as drugs. General knowledges of hormones, hypothalamic and pituitary hormones, thyroid and thyroid inhibitors, adrenocorticosteroids and adrenocortical antagonists, catecholamines and adrenoceptor antagonist drugs of adrenal medulla, estrogens and progestins, hormonal contraceptives, hormonal replacement therapy, androgens and related compounds, agents causing contraction or relaxation of uterus, agents affecting bone mineral homeostasis, insulin, oral hypoglycemic agents and pancreatic hormones, anti-inflammatory and immunosuppresant drugs.	know and can explain about basic knowledge of current concepts in the pharmacology of hormones that produced from the endocrine system and use of these hormones as drugs, agents causing contraction or relaxation of the uterus, agents affecting bone mineral homoeostasis, insulin, oral hypoglycemic agents and pancreatic hormones, anti-inflammatory and immunosuppressant drugs

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115774 Applied Pharmacognosy	4(4-0-12)	None	Applications in pharmacognosy, i.e., taxonomy of medicinal plants and important chemical substances, biological evaluation of natural products, medicinal plant formulations, nutraceutical from plants, cosmetics from natural products, Thai and world markets of medicinal plants, medicinal plant products from Thai hospitals and private companies, medicinal plant products from government pharmaceutical organization, application of medicinal plants in diary use, Thai government law concerning medicinal plant products.	know and can explain about basic knowledge of applications in pharmacognosy, the taxonomy of medicinal plants and essential chemical substances. The medicine, nutraceutical and cosmetics from plants, application of herbs in diary use, Thai government law concerning medicinal plant products
115775 Phytochemistry	4(4-0-12)	None	Physical, chemical, biochemical and biological properties of drug substances of medicinal plant as well as the search for new drugs from natural sources. Research problems in pharmacognosy include studies in the areas of phytochemistry, biosynthesis, biotransformation and chemotaxonomy.	know and can explain about basic knowledge of physical, chemical, biochemical and biological properties of drug substances of the medicinal plant, research problems in pharmacognosy include studies in the areas of phytochemistry, biosynthesis, biotransformation and chemotaxonomy

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115776 Drug Toxicology	4(4-0-12)	None	Clinical principles of medical toxicology, managing patients with an unknown overdose, toxicity of analgesics and over-the-counter preparations, prescription medications, psychopharmacologic medications, alcohols and drugs of abuse.	know and can explain about basic knowledge of clinical principles of medical toxicology, managing patients with an unknown overdose, toxicity of alcohols and drugs of abuse
115777 Systems Toxicology	4(4-0-12)	None	General approaches to human toxicology, biochemical and molecular basis of human toxicology, pathophysiologic basis of human toxicology, organ system approach.	know and can explain about basic knowledge of General approaches to human toxicology, biochemical and molecular basis of human toxicology, the pathophysiologic basis of organ system approach
115778 Nutrition and Immune Function	4(4-0-12)	None	Evaluation of effects of nutrients on immune functions, malnutrition problems, growth retardation and immunity, association of individual nutrients with infection and immune functions, probiotics and immunity, food allergy, and recent researches on nutrition and immunity.	know and can explain about basic knowledge of the evaluation of effects of nutrients on immune functions, malnutrition problems, probiotics and immunity, food allergy, and recent researches on nutrition and immunity
115779 Reproductive and Developmental Toxicology	4(4-0-12)	None	Studies of cellular and molecular mechanisms of reproductive toxicology, interpretation of reproductive significance of molecular and cellular responses to chemicals and knowledge of current methodology used in reproductive toxicology.	know and can explain about basic knowledge of cellular and molecular mechanisms of reproductive and developmental toxicology, knowledge of current methodology used in reproductive toxicology

<b>Courses</b>	<b>Credit</b> (Lect.-Lab-Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115870 Principles of Toxicology	4(4-0-12)	109700 Graduate Biochemistry and 115701 Cellular and Molecular Biology or Consent of the School	History and scope of toxicology, dose-response relationship, principles underlying absorption, distribution, and excretion of toxicants, biotransformation of toxicants, factors influencing toxicity, types and mechanisms of toxic action, experimental methods used to assess toxicity, and recent researches on toxicity of specific classes of toxicants.	know and can explain about basic knowledge of history and scope of toxicology, pharmacokinetic and pharmacodynamic of toxicants, types and mechanisms of toxic action, experimental methods used to assess toxicity, and recent researches on the toxicity of specific classes of toxicants
115871 Drugs of Abuse	4(4-0-12)	None	Overview of chemicals that are commonly abused in our current society. Study on classes of drug and effects of each class of drug and mechanisms of action, common methods of administration and neurological impact on the brain. Treatment of drug addiction and an overdose will be discussed.	know and can explain about basic knowledge of classes of abuse drug and effects of each type of drug and mechanisms of action, neurological impact on the brain. Treatment of drug addiction and an overdose
115872 Advanced Immunotoxicology	4(4-0-12)	115777 Systems Toxicology or consent of the school	Overview of the immune system, harmful effects of environmental agents on immune responses including immunosuppression, allergy and autoimmunity, mechanisms of immunotoxicants and techniques used in immunotoxicology.	know and can explain about basic knowledge of harmful effects of environmental agents on immune responses including immunosuppression, allergy and autoimmunity, mechanisms of immunotoxicants and techniques used in immunotoxicology

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115873 Advanced Genetic Toxicology	4(4-0-12)	115777 Systems Toxicology or consent of the school	Studies of interactions and effects of chemical and physical agents on processes of heredity, nature of genetic alterations and lesions in humans, association of genetic defects with human diseases, roles of genotoxic agents and their mechanisms in inducing genetic damages, mutagenesis, carcinogenesis and teratogenesis, and methods for testing and strategies for monitoring and estimation genotoxic risks for occupational and environmental exposures.	know and can explain about basic knowledge of interactions and effects of chemical and physical agents on processes of heredity, genetic alterations and lesions in humans, roles of genotoxic agents and their mechanisms in inducing genetic damages, mutagenesis, carcinogenesis and teratogenesis, and methods for testing and strategies for monitoring and estimation genotoxic risks

Courses	Credit (Lect.-Lab- Self stud.)	Prerequisite	Course Description	Expected Learning Outcomes
115874 Drugs from Nature	4(4-0-12)	None	Studies of issues of drugs from nature and natural products that have been used as antibiotics, antipyretic, analgesics, antimalarial drugs, immunosuppressant drugs, drugs used in cardiovascular diseases, antihypercholesterolemic drugs, antidiabetic drugs, hormone antagonists, anticancer drugs and insecticides, also emphasizing on evaluation of crude drugs, phytochemistry, basic biosynthetic pathway of chemical constituents in plants, phytochemical screening, isolation, separation and identification of active principles from natural products, novel research approach to development drug from natural substances.	know and can explain about basic knowledge of medicines from nature and natural products that have been used as medicines, phytochemistry, the basic biosynthetic pathway of chemical constituents in plants, phytochemical screening, isolation, separation and identification of active principles from natural products, novel research approach to development drug from natural substances
<b>Elective Courses</b>				
115704 Biosafety	2(2-0-6)	None	Studies of knowledge and skills for practicing and procedures about biohazards which emphasis on biosafety in microbiological and biomedical laboratories. Transport of infectious substances and infection control for dangerous viral diseases.	1. know how to practicing and procedures about biohazards 2. know how to transport of infectious substances and infection control for dangerous diseases

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115706 Biomedical Informatics	2(2-0-6)	None	Studies a management of data from microarrays, mass-spectrophotometry, and beyond after the completion of human genome project and applications in medical fields. Class will consist of a combination of lecture and individual presentation with emphasis on data produced by micro-arrays and mass-spectrophotometry in the pathology field.	1. manage big data involved human genome project 2. apply the knowledge into their research works pertinent to medicine and daily life
115757 Academic and Scientific Writing for Biomedical Sciences	2(1-3-4)	English I-III or equivalent	This course is aimed to prepare Biomedical students who are not native English speakers for their academic and scientific English writing skills. A mock trial of article writing will be conducted from basic until the completion. In addition, each student should be able to explain what it really means in the abstract.	1. write academic and research documents properly 2. apply the academic and scientific writing into their research manuscripts
115765 Advanced Pathology of Cells	3(3-0-9)	None	Studies on molecular and regulatory events during pathogenesis of the cells. In particular, the class will consist of a combination of lecture and an article appraisal per student.	1. explain the molecular control at cellular level 2. apply the knowledge into their research works pertinent to medicine and daily life
115787 Stem Cell, Tissue and Organ Transplantation Immunology	4(4-0-12)	None	Concepts and principles of determining compatibility between donor and recipient, immunology against stem cell, tissue and organ transplantation, ethical concern and new technology in transplantation.	1. know principle of determining the compatibility between donor and recipient 2. explain the function of immune system against cell-tissue-organ transplantation 3. know the ethic of cell-tissue-organ transplantation

<b>Courses</b>	<b>Credit (Lect.-Lab- Self stud.)</b>	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115788 Holistic Medicine and Biomedical Sciences	4(4-0-12)	None	Concepts and principles of holistic medicine in various aspects including nutrition, body, mind, music, medicinal plants and acupuncture.	1. understand concepts and principles of holistic medicine in various aspects including nutrition, body, mind, music, medicinal plants and acupuncture 2. explain the application of holistic medicine in various aspects including nutrition, body, mind, music, medicinal plants and acupuncture in daily life
115980 Advanced Molecular Medical Technology	4(4-0-12)	None	Concept and principle of advanced molecular medical technology and medical applications in different aspects including DNA technology, RNA technology, protein technology, molecular diagnosis and current molecular medical technology	1. understand concept and principle of advanced molecular medical technology and medical applications including DNA technology, RNA technology, protein technology and molecular diagnosis 2. update current molecular medical technology
205501 Entrepreneurship and Innovation	2(2-0-4)	Consent of the School	Study of entrepreneurship and innovation and technology business, open innovation, attitudes and motivation of innovative entrepreneurs and social entrepreneurs, characteristics of successful entrepreneurs, new venture process model generation and business plan, business frost & Sullivan feasibility and problems of ventures.	
<b>Seminar courses</b>				
115791 Seminar in Biomedical Sciences I	1(1-0-3)	None	Literature review and seminar presentation on specific topics in biomedical sciences.	1. have skills to read academic papers 2. have skills to present academic papers 3. have skills in using information technology for searching data and presentation

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115792 Seminar in Biomedical Sciences II	1(1-0-3)	115791 Seminar in Biomedical Sciences I	Literature review and seminar presentation on specific topics in biomedical sciences.	<ol style="list-style-type: none"> <li>1. improve skills to read academic papers</li> <li>2. improve skills to present academic papers</li> <li>3. improve skills in using information technology for searching data and presentation</li> <li>4. have skill to write an abstract</li> <li>5. understand basics in biomedical sciences research</li> </ol>
115793 Seminar in Biomedical Sciences III	1(1-0-3)	115792 Seminar in Biomedical Sciences II	Literature review and seminar presentation on specific topics in biomedical sciences.	<ol style="list-style-type: none"> <li>1. improve skills to read academic papers</li> <li>2. improve skills to present academic papers</li> <li>3. improve skills in using information technology for searching data and presentation</li> <li>4. improve skill to write an abstract</li> <li>5. understand basics in biomedical sciences research</li> <li>6. know current research techniques in biomedical sciences and understand the reasons for selection</li> </ol>
<b>Special Problems and Current Issues Courses</b>				
115680 Special Problems in Anatomy	4(0-12-12)	None	Research work to be completed within one trimester on a specific topic within anatomy.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in anatomy</li> <li>3. apply scientific principles and methodologies to anatomy researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using anatomy knowledge</li> <li>7. improve written and presentation skills</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115681 Special Problems in Physiology	4(0-12-12)	None	Research work to be completed within one trimester on a specific topic within physiology.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in physiology</li> <li>3. apply scientific principles and methodologies in physiology researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using physiology knowledge</li> <li>7. improve written and presentation skills</li> </ol>
115682 Special Problems in Cellular and Molecular Medicine	4(0-12-12)	None	Research work to be completed within one trimester on a specific topic within cellular and molecular medicine.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in cellular and molecular medicine</li> <li>3. apply scientific principles and methodologies in cellular and molecular medicine researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using cellular and molecular medicine knowledge</li> <li>7. improve written and presentation skills</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115683 Special Problems in Host/Pathogen Interactions	4(0-12-12)	None	Research work to be completed within one trimester on a specific topic within host/pathogen Interactions.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in host/pathogen Interactions</li> <li>3. apply scientific principles and methodologies in host/pathogen Interactions researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using host/pathogen Interactions knowledge</li> <li>7. improve written and presentation skills</li> </ol>
115684 Special Problems in Pathobiology	4(0-12-12)	None	Research work to be completed within one trimester on a specific topic within pathobiology.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in pathobiology</li> <li>3. apply scientific principles and methodologies in pathobiology researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using pathobiology knowledge</li> <li>7. improve written and presentation skills</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115685 Special Problems in Pharmacology and Toxicology	4(0-12-12)	None	Research work to be completed within one trimester on a specific topic within pharmacology and toxicology.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in pharmacology and toxicology</li> <li>3. apply scientific principles and methodologies in pharmacology and toxicology researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using pharmacology and toxicology knowledge</li> <li>7. improve written and presentation skills</li> </ol>
115686 Current Issues in Anatomy	4(4-0-12)	None	Lectures and discussion on current issues or recent developments in anatomy. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in anatomy, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in anatomy, varying by issues given</li> <li>3. develop proficiency in current issues in anatomy, varying by issues given</li> </ol>
115687 Current Issues in Physiology	4(4-0-12)	None	Lectures and discussion on current issues or recent developments in physiology. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in physiology, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in physiology, varying by issues given</li> <li>3. develop proficiency in current issues in physiology, varying by issues given</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115688 Current Issues in Cellular and Molecular Medicine	4(4-0-12)	None	Lectures and discussion on current issues or recent developments in cellular and molecular medicine. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in cellular and molecular medicine, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in cellular and molecular medicine, varying by issues given</li> <li>3. develop proficiency in current issues in cellular and molecular medicine, varying by issues given</li> </ol>
115689 Current Issues in Host/Pathogen Interactions	4(4-0-12)	None	Lectures and discussion on current issues or recent developments in host/pathogen Interactions. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in host/pathogen Interactions, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in host/pathogen Interactions, varying by issues given</li> <li>3. develop proficiency in current issues in host/pathogen Interactions, varying by issues given</li> </ol>
115690 Current Issues in Pathobiology	4(4-0-12)	None	Lectures and discussion on current issues or recent developments in pathobiology. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in pathobiology, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in pathobiology, varying by issues given</li> <li>3. develop proficiency in current issues in pathobiology, varying by issues given</li> </ol>
115691 Current Issues in Pharmacology and Toxicology	4(4-0-12)	None	Lectures and discussion on current issues or recent developments in pharmacology and toxicology. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in pharmacology and toxicology, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in pharmacology and toxicology, varying by issues given</li> <li>3. develop proficiency in special topics in pharmacology and toxicology, varying by issues given</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115880 Special Problems in Advanced Anatomy	4(0-12-12)	115680 Special Problems in Anatomy	Research work to be completed within one trimester on a specific topic within advanced anatomy.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in advanced anatomy</li> <li>3. apply scientific principles and methodologies in advanced anatomy researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using advanced anatomy knowledge</li> <li>7. improve written and presentation skills</li> </ol>
115881 Special Problems in Advanced Physiology	4(0-12-12)	115681 Special Problems in Physiology	Research work to be completed within one trimester on a specific topic within advanced physiology	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in advanced physiology</li> <li>3. apply scientific principles and methodologies in advanced physiology researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using advanced physiology knowledge</li> <li>7. improve written and presentation skills</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115882 Special Problems in Advanced Cellular and Molecular Medicine	4(0-12-12)	115682 Special Problems in Cellular and Molecular Medicine	Research work to be completed within one trimester on a specific topic within advanced cellular and molecular medicine.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in advanced cellular and molecular medicine</li> <li>3. apply scientific principles and methodologies in advanced cellular and molecular medicine researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using advanced cellular and molecular medicine knowledge</li> <li>7. improve written and presentation skills</li> </ol>
115883 Special Problems in Advanced Host/Pathogen Interactions	4(0-12-12)	115683 Special Problems in Host/Pathogen Interactions	Research work to be completed within one trimester on a specific topic within advanced host/pathogen Interactions.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in advanced host/pathogen Interactions</li> <li>3. apply scientific principles and methodologies in advanced host/pathogen Interactions researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using advanced host/pathogen Interactions knowledge</li> <li>7. improve written and presentation skills</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115884 Special Problems in Advanced Pathobiology	4(0-12-12)	115684 Special Problems in Pathobiology	Research work to be completed within one trimester on a specific topic within advanced pathobiology.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in advanced pathobiology</li> <li>3. apply scientific principles and methodologies in advanced pathobiology researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using advanced pathobiology knowledge</li> <li>7. improve written and presentation skills</li> </ol>
115885 Special Problems in Advanced Pharmacology and Toxicology	4(0-12-12)	115685 Special Problems in Pharmacology and Toxicology	Research work to be completed within one trimester on a specific topic within advanced pharmacology and toxicology.	<ol style="list-style-type: none"> <li>1. improve skills in using information technology for searching data and presentation</li> <li>2. design and carry out their own experiment in advanced pharmacology and toxicology</li> <li>3. apply scientific principles and methodologies in advanced pharmacology and toxicology researches</li> <li>4. select the appropriate tools, equipment and materials for the experiment</li> <li>5. analyze, interpret and evaluate data from the experiment</li> <li>6. debate and criticize the results from the experiment using advanced pharmacology and toxicology knowledge</li> <li>7. improve written and presentation skills</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab-Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115886 Current Issues in Advanced Anatomy	4(4-0-12)	115686 Current Issues in Anatomy	Lectures and discussion on current issues or recent developments in advanced anatomy. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in advanced anatomy, varying by issues s given</li> <li>2. demonstrate understanding of and competence in up to date current issues in advanced anatomy, varying by issues given</li> <li>3. develop proficiency in current issues in advanced anatomy, varying by issues given</li> </ol>
115887 Current Issues in Advanced Physiology	4(4-0-12)	115687 Current Issues in Physiology	Lectures and discussion on current issues or recent developments in advanced physiology. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in advanced physiology, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in advanced physiology, varying by issues given</li> <li>3. develop proficiency in current issues in advanced physiology, varying by issues given</li> </ol>
115888 Current Issues in Advanced Cellular and Molecular Medicine	4(4-0-12)	115688 Current Issues in Cellular and Molecular Medicine	Lectures and discussion on current issues or recent developments in advanced cellular and molecular medicine. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in advanced cellular and molecular medicine, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in advanced cellular and molecular medicine, varying by issues given</li> <li>3. develop proficiency in current issues in advanced cellular and molecular medicine, varying by issues given</li> </ol>
115889 Current Issues in Advanced Host/Pathogen Interactions	4(4-0-12)	115689 Current Issues in Host/Pathogen Interactions	Lectures and discussion on current issues or recent developments in advanced host/pathogen Interactions. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in advanced host/pathogen Interactions, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in advanced host/pathogen Interactions, varying by issues given</li> <li>3. develop proficiency in current issues in advanced host/pathogen Interactions, varying by issues given</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115890 Current Issues in Advanced Pathobiology	4(4-0-12)	115690 Current Issues in Pathobiology	Lectures and discussion on current issues or recent developments in advanced pathobiology. (Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in advanced pathobiology, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in advanced pathobiology, varying by issues given</li> <li>3. develop proficiency in current issues in advanced pathobiology, varying by issues given</li> </ol>
115891 Current Issues in Advanced Pharmacology and Toxicology	4(4-0-12)	115691 Current Issues in Pharmacology and Toxicology	Lectures and discussion on current issues or recent developments in advanced pharmacology and toxicology. ( Issues will be announced when opened)	<ol style="list-style-type: none"> <li>1. explain substantial knowledge obtained from current issues in advanced pharmacology and toxicology, varying by issues given</li> <li>2. demonstrate understanding of and competence in up to date current issues in advanced pharmacology and toxicology, varying by issues given</li> <li>3. develop proficiency in current issues in advanced pharmacology and toxicology, varying by issues given</li> </ol>
<b>Thesis Courses</b>				

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115798 M.Sc. Thesis Scheme A2	16(16-0-0)	None	M.Sc. Thesis for scheme A2	<ol style="list-style-type: none"> <li>1. select, use and critically evaluate a variety of appropriate information sources for data searching and presentation</li> <li>2. apply scientific principles and methodologies in thesis research</li> <li>3. describe concepts in biomedical sciences for questions or problems related to the thesis</li> <li>4. demonstrate the skills required to plan, implement, draw conclusions, evaluate and report on a program of thesis</li> <li>5. learn and follow ethical guidelines for working in biomedical sciences</li> <li>6. perform research that will create new knowledge</li> <li>7. select the appropriate tools, equipment and materials for the experiment</li> <li>8. analyze, interpret and evaluate data from the experiment</li> <li>9. debate and criticize results from the experiment using knowledge in biomedical sciences</li> <li>10. communicate effectively in written and oral formats, as well as, appropriate graphical style</li> <li>11. prepare and present scientific reports according to professional standards</li> <li>12. work independently and as part of an ability-developing team to work autonomously</li> </ol>

<b>Courses</b>	<b>Credit</b> (Lect.-Lab- Self stud.)	<b>Prerequisite</b>	<b>Course Description</b>	<b>Expected Learning Outcomes</b>
115799 M.Sc. Thesis Scheme A1	46(0-0-0)	None	M.Sc. Thesis for scheme A1	<ol style="list-style-type: none"> <li>1. select, use and critically evaluate a variety of appropriate information sources for data searching and presentation</li> <li>2. apply scientific principles and methodologies in thesis research</li> <li>3. describe concepts in biomedical sciences for questions or problems related to the thesis</li> <li>4. demonstrate the skills required to plan, implement, draw conclusions, evaluate and report on a program of thesis</li> <li>5. learn and follow ethical guidelines for working in biomedical sciences</li> <li>6. perform research that will create new knowledge</li> <li>7. select the appropriate tools, equipment and materials for the experiment</li> <li>8. analyze, interpret and evaluate data from the experiment</li> <li>9. debate and criticize results from the experiment using knowledge in biomedical sciences</li> <li>10. communicate effectively in written and oral formats, as well as, appropriate graphical style</li> <li>11. prepare and present scientific reports according to professional standards</li> <li>12. work independently and as part of an ability-developing team to work autonomously</li> </ol>