Doctor of Philosophy Program in Biology (International Program)

In reviewing process, the subjects will be slightly adapted

Clarification of the code

Example 3((3)-0-6)

Number of credit((lecture hrs*)-lab hrs*-self-study hrs*)

*hrs per week

330-501 (Paleobotany) 3(2-3-4)

Phylogeny, classification, taphonomy and paleoecology (e.g. plant - climate / plant-animal interactions) of fossil plants; practice incudes field trips; study of paleobotanical techniques and specimens

330-502 (Zoogeography) 2(2-0-4)

Prerequisites: Ecology or equivalent

Distribution of animals according to evolution and ecology; land masses structure; impacts of physical as well as biological factors to animals distributions; animals habitats as well as biogeography islands and Ocean

330-503 (Plant Geography) 3(2-3-4)

Prerequisites: Ecology or equivalent

Definition and history of plant geography, origin, evolution and distribution of plants relating to world geography, tectonic movement effects to plant distribution patterns, effects of environmental factors and human to plant distribution; vegetation communities of the world and Thailand

330-504 (Biogeography) 2(2-0-4)

Prerequisites: Ecology or equivalent or consent of curriculum council members

Distribution of living organisms in a spatial and temporal context; focusing on pattern of distribution analysis; causes of different patterns of distributions in both plants and animals as well as the relationship of evolutionary dynamic and the impacts of human to ecology and distribution of organism.

330-505 (Systematics Biology) 3(3-0-6)

Principle of systematics biology; evolutionary of classification; philosophy; systematic; classification of microbe, animal and plant; case study

330-506 (Introduction to Philosophy of Science) 2(2-0-4)
Development of scientific thinking through the development of human society to the present time; scientific inquiry as well as scientific process with case study.

330-510 (Advanced Morphology of Vascular Plants) 3(2-3-4)
Prerequisites: Morphology of Vascular Plants or equivalent or consent of curriculum council members
Developmental anatomy and morphogenesis of selected groups of vascular plants by using various techniques; scanning and transmission electron microscopies; plant morphological problems in details, focusing on the current researches of plant morphology

330-512 (Aquatic Insects) 3(2-3-4)
Prerequisites: Entomology or equivalent or consent of curriculum council members
Biology and evolution of aquatic insects; relation between aquatic insects and environments; collection; preservation and identification

330-513 (Palynology) 3(2-3-4)
Prerequisites: General biology or equivalent or consent of curriculum council members
Spore and pollen morphology, evolutionary and morphological trends of spore and angiosperm pollen, pollen and spore morphology of some selected families, applied to the pollination ecology and biology, plant geography, geology, archeology, paleontology, forensic science and medical science including the preparation acetolysis method through permanent slide for light and scanning microscope

330-514 (Teuthology) 3(2-3-4)
Morphology and morphometry; behaviour, growth; life history and life strategy; roles in food chain; origin and evolution; phylogeny; identification and classification; fossil and recent forms; ecology and distribution; aquaculture and utilization of cephalopod

330-515 (Palaeoteuthology) 3(2-3-4)
Morphology and morphometry; life history and life strategy; origin and evolution; phylogeny; identification and classification; fossil and recent forms

330-520 (Photosynthesis) 3(2-3-4)

Prerequisites: Plant physiology or equivalent

Processes and mechanisms of photosynthesis; ecophysiological aspects of photosynthesis; various photosynthetic strategies in different environments and the photosynthetic response to future global change scenarios; photosynthesis measurement techniques; laboratory studies and mini projects

330-521 (Current topic in Plant Physiology) 2(2-0-4)

Prerequisites: Plant physiology or equivalent

A literature review, presentation and discussion on the current topics or concepts in plant physiology; processes and mechanisms of energy production in plant cells, carbohydrate and nitrogen metabolism, plant nutrition, transport and mechanism involving plant growth

330-522 (Plant Metabolism) 3(1-6-2)

Prerequisites: Plant physiology or equivalent

Processes of plant metabolism, principles of metabolism, bioenergetics, metabolism of carbon, nitrogen and sulphur; metabolism of plant products and constituents

330-523 (Insect Morphology and Physiology) 4(3-3-6)

Prerequisites: Entomology or equivalent or consent of curriculum council members

Morphology of structure of insects; comparative study of structure and functional of organs and organ systems of various representative insects

330-527 (Physiological Ecology of Marine Animals) 3(3-0-6)

Prerequisites: Ecology or equivalent or consent of curriculum council members

Physiological adaptation of organisms to their habitats; searching for food and foraging, energy allocation for food, development rate, control of body size, reproduction pattern, adaptation to temperature and response to environmental stress

330-529 (Plant-Water Relations and Mineral Nutrition) 3(3-0-6)

Prerequisites: Plant physiology or equivalent

The relationship between water and plant, problems on water stress, mineral nutrition, principles such as absorption and accumulation of mineral salts, and analysis of elements of plant constituents

330-530 (Advanced Plant Taxonomy) 3(2-3-4)

Prerequisites: Plant taxonomy or equivalent

Development of philosophy of classification systems of plants, plant taxonomic problems and the solution techniques, taxonomic revision works; current researches in plant taxonomy focusing on flowering plants in the peninsular Thailand and the Malesian regions

330-531 (Herpetology) 3(2-3-4)

Prerequisites: General biology or equivalent or consent of curriculum council members

General characteristics of amphibians and reptiles, evolution of food selection, habitats, adaptation and distribution, reproduction and development, population and identification; field trips

330-532 (Biology of Mammals) 3(2-3-4)

Prerequisites: General biology or equivalent or consent of curriculum council members

General morphology of mammals, adaptation in physiology and anatomy, identification, evolution, food, habitats and distribution, growth and development of embryo and behavior, population and conservation of mammals, field studies in natural habitats

330-534 (Biology of Molluscs) 3(2-3-4)

Prerequisites: Invertebrate zoology or equivalent or consent of curriculum council members

Morphology, anatomy, physiology, embryology, ecology and classification of molluscs, with emphasis on medical and economic importance, relationship between host and parasite, pests and horticulture, collection, identification and curation, field surveys

330-536 (Biology of Crustaceans) 3(2-3-4)

Prerequisites: Invertebrate zoology or equivalent

Morphology, anatomy, physiology, embryology, ecology and taxonomy of crustaceans; emphasis on the economic importances, field surveys

330-537 (Biology of Fish Larvae) 3(2-3-4)

Prerequisites: General biology or equivalent or consent of curriculum council members

Biology, taxonomy and ecology of fish larvae, effects of environmental factors on survival of fish larvae.

330-540 (Plant Growth and Development) 3(3-0-6)
Prerequisite: Plant physiology or equivalent
Plant growth regulator and their applications, factors controlling plant growth and development; stress physiology

330-541 (Biology of Animal Development) 3(3-0-6)
Prerequisites: General biology or equivalent or consent of curriculum council members
Animal development from gametogenesis, fertilization, embryonic development through adult emphasized on biochemical changes, morphogenesis, cellular control, induction and environmental factors

330-542 (Insect Growth and Metamorphosis) 3(3-0-6)
Prerequisites: Entomology or equivalent
Insects breeding system, primary growth of their embryos and adults; metamorphosis and the impact factors involved in that process

330-550 (Coral Reef Ecology) 3(2-3-4)
Prerequisites: Ecology and Invertebrate zoology or equivalent with swim ability
Biology of Coelenterate, Taxonomy of corals; the reef forming system; their distribution, relationships between coral reef organisms; nutrient cycling in reef as well as reef conservation

330-551 (Animal Population Ecology) 3(3-0-6)
Prerequisites: Ecology or equivalent
Census of animal populations; life cycle; age distribution in animal population and the life table achievement; the population logistic growth investigation; the relationship in population: predators and preys; the changes and controls of the animal populations with field samples

330-552 (Mangrove Ecology) 3(3-0-6)
Prerequisites: Ecology; Invertebrate zoology or equivalent
Environmental condition of mangrove forests; structure, species composition, distribution of mangrove flora and fauna; interrelationships among organisms and their environment; energy flow, nutrient cycling with emphasis on detrital food chains; utilization and conservation of mangrove forests; field trips and special projects

330-553 (Primate Ecology) 4(4-0-8)

Perquisites: Animals behavior; Animal Population Ecology or equivalent or consent of curriculum council members

Evolution of primate behavior ecology and conservation with mainly lectures, field observations

330-554 (Insect Ecology) 3(2-3-4)

Prerequisites: Ecology or equivalent or consent of curriculum council members

Impacts of the environments to insect life cycle as well as their population density, analysis of population fluctuations and the applications to pest control

330-555 (Tropical Marine Ecology and Coastal Impacts) 3(2-3-4)

Impacts on coastal systems are increasing and include: climate change, fisheries, tourism and development; ecology of marine organisms and impacts on marine coastal assemblages in the Andaman Sea; provide an increased knowledge of marine organisms the impacts faced by tropical; reefs of the world and the potential for sustainable practices

330-556 (Plankton Ecology) 3(2-3-4)

Prerequisites: Ecology or equivalent or consent of curriculum council members

Life history, dynamic interactions and the phytoplankton and zooplankton productions, impact factors to the distribution and density, food chain and fishery products ; the sampling technique, counting; identifying and plankton culture with field trips.

330-558 (Management of Terrestrial Ecosystems) 3(2-3-4)

Prerequisites: Ecology or equivalent or consent of curriculum council members

Soil-ages sequencing, changes and the soli nutrient cycling, soil ecology and the relationships to season changes and organisms

330-559 (Tropical Forest Ecology) 3(3-0-6)

Prerequisites: Ecology or equivalent or consent of curriculum council members

Tropical forest formations, components of tropical forest ecosystems, population biology, nutrient cycling, community structure and functions, plant and animal relationships, wildlife ecology, ecological techniques, important, problems and threats, conservation, management of tropical forests

330-560 (Advance Genetics) 3(3-0-6)
Perquisites: Genetics or equivalent
Genetic theory of genes structures and functions, current technique in genetic engineering and its benefits.

330-561 (Plant Molecular Genetics) 3(3-0-6)
Perquisites: Genetics or equivalent or consent of curriculum council members
Gene structure, function and types of reproduction in higher plants; genetic variation in population; mutation, changes in structure and number of chromosomes and their roles in plant evolution and breeding; transfer of chromosomes and genes from plants to plants; genetic engineering and its potential for plant breeding

330-570 (Photographic Techniques in Biological Research) 3(1-6-2)
Theory and practice of photography as applied to biological research, photomacrography and photomicrography

330-571 (Histochemistry) 3(1-6-2)
Prerequisites: Animal histology or equivalent
Methodology for analysis of the chemical components and enzyme activities of cells and tissues under the microscopy

330-572 (Algal Culture) 3(2-3-4)
Prerequisites: General biology or equivalent or consent of curriculum council members
Biology of the economic important algae, cultural techniques, environmental impacts to algal growth, products, harvesting and their problems with field trips

330-573 (Protoplast Technology) 3(2-3-4)
Prerequisites: Plant tissues and cells culture or equivalent
Enzymatic isolation of protoplasts, protoplast culture, cell wall regeneration, fusion, selection, fusion products and plant regeneration from somatic hybrids

330-574 (Computer Programming and Modelling Techniques in Biology) 3(2-3-4)
Prerequisites: Calculus at least 8 credits; Basic statistic
Applications of computer modeling program for ecology, population genetics and taxonomy by means of mathematical synthesis, statistic and stimulation methods

330-575 (Research Methods in Botany) 2(2-2-2)
Development of concepts and theories in botany, botanical questions, literature review, techniques in botanical research, research planning, data analysis using computer, research presentation and publication

330-576 (Wildlife Sampling Technique) 3(2-3-4)
Concepts and planning process for wildlife sampling, estimate occupancy as surrogate to abundance using repeated presence-absence surveys, estimating & monitoring populations from capture-based methods

330-577 (Advanced Plant Tissue Culture) 3(2-3-4)
Prerequisites: Plant Tissues and organs culture or consent of curriculum council members
Tissue culture of economic tropical trees e.g. fruit trees and forest trees; techniques of in vitro culture for rejuvenation and for prevention and solving problems of explant browning and contamination, tissue culture of economic ornamentals and vegetables; use of tissue culture techniques for rapid mass propagation of desirable and selected plants

330-578 (Techniques in Plankton Identification) 3(1-6-2)
Prerequisites: Phycology or Planktonology or equivalent or consent of curriculum council members
Basic knowledge on morphology of plankton, techniques in plankton identification, preparation of permanent slide for reference collection, preparation and identification of plankton with light and electron microscope

330-579 (Design & Analysis of Ecological Studies) 3(3-0-6)
Development of problem-solving skills and practical solutions to the collection of field data; Critical analysis and interpretation of field data and previously published studies;
Application of statistical methodology to experimental design, focusing on data quality and design robustness; Development of competencies in written and verbal communication of scientific ideas and results

330-581 (Animal-Plant Interactions) 3(3-0-6)
Prerequisites: General Biology or equivalent or consent of curriculum council members
Interactions between plants and animals especially herbivores, commensalism ecology and the evolution of the herbivores.

330-582 (Ecotoxicology) 3(3-0-6)

Prerequisites: Ecology or equivalent or consent of curriculum council members

The impacts of the environmental contaminants to the organisms and the environment as well as the ecosystem with the focus on the non-mortal impacts to the animal physiology

330-583 (Principle of Sociobiology) 4(3-3-6)

Prerequisites: Ecology and animal behavior or equivalent or consent of curriculum council members

Evolution of various species social behaviors including human, functions and social behavioral process, social ability and isolated groups, territory, social signals, various breeding ecology, sex selection system, siblings selection theory, groups and populations selections, interactions between parents and juveniles, social hierarchy of insects, other invertebrates and primates as well as the principles of social evolutions with lectures and field trips.

330-585 (Behavioural Ecology) 3(2-3-4)

Prerequisites: Ecology or equivalent or consent of curriculum council members

Query and hypothesis in evolutions and adaptation behavior, hypothesis testing of behavioral ecology, economic decision making process of animal behavior, interactions between predators and preys, competitions for food, accommodations, breeding, social ability, sex conflicts, sex selections, juveniles maintenance, couple matching, selfish behavior, devoting behavior of various animals

330-586 (Application of Statistics for Biological Research) 4(3-3-6)

Sampling, data collection for Biology, data analysis and interpretations as well as reporting, statistical references for Science, biological stat applications, especially in distribution patterns, density, impacts of biological parameter to populations, frequency analysis, multi-relations, regressions, one-way statistical analysis as well as two-ways statistic alanalysis, non-parameter statistics, multi-variant statistic in Biological Science with exercise and biological special problems

330-587 (Principles of Scientific Inquiry) 3(2-3-4)

Principles of epistemology and philosophy of science, sources of knowledge, limitation to an understanding of natural phenomena, modes of acquisition of knowledge, scientific method and attitude, principles of causality, scientific explanation, research process and the use of elementary statistics in research design and the analysis of biological data, statistical packages, publication of research finding, ethical issues in scientific research.

330-588 (Evolutionary Ecology) 3(2-3-4)

Prerequisites: consent of curriculum council members

Adaptation of organisms to their environments, including their interactions with members of their own and other species (the biotic environment) as well as the physical environment; principle of natural selection; the selective pressures imposed by the environment and the evolutionary response; predictive and optimization models; the comparative method; and direct measurement of natural selection; problem-based learning, group discussion, seminar presentation and essay writing

330-589 (Coastal Botany) 3(2-3-4)

Prerequisites: Plant Taxonomy or equivalent and Plant ecology

Distribution patterns, phytosociology, morphological and physiological adaptations of native plants in various plant communities along the coast in Peninsular Thailand and the Malesian region together with identification techniques, current researches in taxonomy, phytogeography and plant ecology of the plant communities along the coast, focusing in peninsular Thailand and Malaysia, including field surveys

330-601 (Plant Evolution) 3(3-0-6)

Prerequisites: Plant morphology or equivalent

Evolution in various groups of plants including green algae, bryophytes, and tracheophytes; evolutionary trends in various groups of plants; coevolution; relationships between plants and their habitats

330-602 (Advanced Cell Biology) 3(2-3-4)

Prerequisites: Cells biology or equivalent or consent of curriculum council members

Studies of selected topics in cell biology, including microscopy, electron microscopy, X-ray diffraction, cellular molecules, cellular transportation, cell injury and aging, molecular genetics, cell differentiation, cellular basis of immune system

330-630 (Current topic in Plant Taxonomy) 3(2-3-4)

Prerequisites: Plant taxonomy or equivalent

The current research in plant taxonomy; taxonomic concepts and international code of nomenclature; information for identification and taxonomic revision; discussion on current knowledge and methodology in plant taxonomy; case study of plant taxonomic problem; individual study of interesting plant taxonomic problem.

330-641 (Plant Morphogenesis) 3(2-3-4)

Prerequisites: Plant physiology or equivalent

Origin and development of plant form and structure, cell division, cell elongation, cell differentiation, including factors controlling the form of a plant and its various organ

330-651 (System Ecology) 3(2-3-4)

Prerequisites: Ecology or equivalent or consent of curriculum council members

Changes, termination and development of ecosystems, mathematical analysis, Biological phenomena modeling, Computer application for ecosystems analysis.

330-652 (Global Environmental Change) 2(2-0-4)

Prerequisites: Ecology or equivalent or consent of curriculum council members

Anthropogenic impacts to the atmospheric chemical, source and productions of Carbon-dioxide, Freon, Sulfur-dioxide and other greenhouse gases, evident and global weather changes in the pass, weather fluctuations from the green-house effects measurements, impacts of the global heat, the Ozone hole and the Acid rain phenomena

330-653 (Human Ecology) 3(3-0-6)

Prerequisites: Ecology or equivalent or consent of curriculum council members

Human population, living and food production, agricultural system, impacts of environment, social and culture to Human process, Ecology and disease control as well as parasitism, pollutions, bio-resources conservation, advantages vs. disadvantages of life quality developments

330-661 (Molecular Technique in Biology) 3(2-3-4)

Prerequisites: Genetics or equivalent or consent of curriculum council members

DNA and RNA extraction; polymerase chain reaction; DNA sequencing; gene expression analysis; bioinformatics; genomics, transcriptomics and proteomics; functional analysis of genes; transgenic techniques

330-670 (Scientific Diving and Data Collection) 2(1-2-3)

Establishment of competencies in SCUBA diving and snorkeling (free-diving) sufficient to safely and reliably engage in marine field work at an international standard; Development of practical skills in diving operations, data collection, equipment use and basic maintenance, and sample collection and storage for various types of study; Exposure to different types of SCUBA and free-diving equipment used in marine data collection;

Development of safety awareness and first aid/rescue skills, awareness of the ways diving can affect physiology and techniques and skills to avert potential health risks that can arise from diving; Application of skills to plan and undertake multi-level and extended dive profiles safely in the context of research diving operations

330-671 (Ecological Methods) 3(2-3-4)
Prerequisites: Ecology or equivalent or consent of curriculum council members
Methods in Ecology; population studies in various habitats; population assessment; biodiversity assessment; productivity estimation and estimation of energy flow; landscape ecology

330-673 (Seminar in Biology I) 1 1(0-2-1)
Presentation and discussion of the interesting and recent scientific topics in biology

330-674 (Seminar in Biology II) 2 1(0-2-1)
Review literatures, researches proposal and progress of Master thesis

330-682 (Special Topic in Biology I) 1 2(1-3-2)
Prerequisites: consent of instructors
Special topics on current and hot issues in biology

330-683 (Special Topic in Biology II) 2 2(1-3-2)
Prerequisites: consent of instructors
Special topics on current and hot issues in biology

330-684 (Special Problem in Biology I) 1 2(1-3-2)
Prerequisites: consent of instructors
Special problem on current and hot issues in biology

330-685 (Special Problem in Biology II) 2 2(1-3-2)
Prerequisites: consent of instructors
Special problem on current and hot issues in biology

331-691 (Thesis) 36(0-108-0)
Individual research in biological problems under supervision of the advisory committee

331-692 (Thesis) 20(0-60-0)
Individual research in biological problems under supervision of the advisory committee

330–770 (Seminar in Biology I) **1 1(0-2-1)**

Presentation and discussion of the interesting and recent scientific topics in biology

330–771 (Seminar in Biology II) **2 1(0-2-1)**

Presentation and discussion of the interesting and recent scientific topics in biology

331-791 (Thesis) **48(0-144-0)**

Individual research in biological problems under supervision of the advisory committee

331-792 (Thesis) **72(0-216-0)**

Individual research in biological problems under supervision of the advisory committee

331-793 (Thesis) **36(0-108-0)**

Individual research in biological problems under supervision of the advisory committee

331-794 (Thesis) **48(0-144-0)**

Individual research in biological problems under supervision of the advisory committee