

Graduate Programs in Biochemistry and Biochemical Technology at Suranaree University of Technology

Requirements for a graduate degree in Biochemistry and Biochemical Technology from Suranaree University of Technology, administered by the School of Chemistry, Institute of Science, SUT are as summarized in the following tables.

1. MSc Degree Programs

Program Course Type	M.Sc. Program Types	
	Type 1.1 (Thesis only)	Type 1.2 (Thesis + Classes)
Required Courses	-	16
Elective Courses	-	4
Seminar	-	2
Thesis	45	24
Total	45	45

2. Ph.D. Programs

Program:	Ph.D. Program Type		
Course Type	1.1 (Thesis only, M.Sc. holder)	2.1 (Thesis + classes, M.Sc. holder)	2.2 (Thesis + classes, B.Sc. holder)
Required Courses	-	8	16
Elective Courses	-	5	10
Seminar	4 (no credits counted)	2	4
Thesis	60	45	60
Total	60	60	90

3 Classes

3.1 Required Courses

	Number of credits (hours lecture-laboratory-self study/week)
109700 Graduate Biochemistry	4(4-0-8)
109701 Biochemical Separation and Characterization Methods	4(1-9-2)
109702 Enzymology	4(4-0-8)
109703 Protein Structure and Engineering	4(4-0-8)
109704 Nucleic Acids and Recombinant DNA Technology	4(4-0-8)
109706 Biochemical Instrumentation	4(3-3-6)
109707 Bioinformatics and Computer Usage	2(1-3-2)
109708 Selected Research Project	4(0-12-0)

3.2 Elective Courses

109711 Principles of Transport across Membranes	2(2-0-4)
109721 Advanced Bioinformatics and Biochemical Computing	3(3-0-6)
109724 Genomics, Functional Genomics	3(3-0-6)
109731 Clinical Biochemistry	3(3-0-6)
109732 Biochemical Immunology	4(4-0-8)
109733 Biochemistry and Molecular Biology of Cancers	4(4-0-8)
109734 Biochemistry for Healthcare Products and Cosmeceuticals	4(4-0-8)
109735 Formulation and Analysis of Healthcare and Cosmeceutical Products	4(2-6-4)
109741 Plant Biochemistry	4(4-0-8)
109742 Plant Secondary Metabolism and Application	2(2-0-4)
109743 Microbial Biochemistry	4(4-0-8)
109752 Antibody Technology	3(3-0-6)
109771 Current Topics in Biochemistry	3(3-0-6)
109774 Practical in Protein Crystallography and Small Angle X-ray Scattering	4(1-9-2)
109775 Principles of Macromolecular Crystallography and Small Angle X-ray Scattering	4(4-0-8)

3.3 Seminar classes

109881 Biochemistry Seminar I	1(0-1-2)
109882 Biochemistry Seminar II	1(0-1-2)

3.4 Thesis

109791	M.Sc. Thesis
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	A1	45 credits
	A2	24 credits
109891	PhD Thesis	
	1.1	60 credits
	2.1	45 credits
	2.2	60 credits

4. Details of Courses:

109700 Graduate Biochemistry

4(4-8)

Prerequisite: Consent of the School

Cellular structure, organelle function, structure and properties of lipids, carbohydrates and other biomolecules, methods of study, enzymes, intermediary metabolism, metabolic control, membrane structure and transport, bioenergetics, information transfer, cell signaling, DNA replication, RNA and protein synthesis

Expected Learning Outcomes

On completion of this course, students are able to

1. explain structure and function of different biological molecules existing in living cells
2. explain metabolic pathways of energy- conserved compounds and metabolic controls as different levels
3. explain cell signaling and cell- cell interactions through signaling molecules.
4. explain workflow of DNA replication, RNA and protein synthesis
5. communicate scientific knowledge in different forms effectively and appropriately
6. be honest and able to work with other and respect others opinions

109701 Biochemical Separation and Characterization Methods 4(1-9-2)

Prerequisite : Consent of the School

Laboratory studies and general principles, separation of organelles, separation detection, quantification of proteins, quantification of nucleic acids, quantification of carbohydrates, quantification of lipids, spectrophotometry and other spectroscopic methods.

Expected Learning Outcomes

On completion of this course, students are able to

1. Conduct basic laboratory techniques used in biochemistry and able to choose the appropriated techniques for biochemical work
2. Understand the basic principles between laboratory techniques for purification and characterization of biomolecules
3. Document laboratory work in a notebook and write reports regarding experimental projects
4. Classify, collect, and analysis the numerical data
5. Evaluate and analyze scientific data according to the scientific information

6. Communicate scientific knowledge in different forms effectively and appropriately
7. Be conscientious in their academic and professional conduct, able to work with other, and respect others opinions

109702 Enzymology

4(4-0-8)

Prerequisite : Consent of the School

Properties and control of enzyme activity, enzyme nomenclature and active-site characteristics, thermodynamics of enzyme-catalyzed reactions, orders of reactions and kinetics of Michaelis-Menten, experimental measurements and significance of the kinetic parameters, kinetic of substrate inhibition, kinetics of reversible reactions, and the Haldane relationship, kinetics of competitive, non-competitive, uncompetitive and mixed-type inhibition, effects of pH and temperature on enzyme activity, dose-respond curves, protein-ligand binding equilibria, derivation of the Langmuir binding isotherm, binding kinetics using microcalorimetric assay, mechanisms of multisubstrate reactions as described by King-Altman schematic approach, kinetics of allosteric enzymes, enzyme mechanisms and active site determination, practical approaches for determination of enzyme activity.

Expected Learning Outcomes

On completion of this course, students are able to

1. explain enzyme property as a biocatalyst
2. describe the reaction rate, following Michaelis-Menten equation.
3. determine the reaction rate of an enzyme with two substrates
4. distinguish different types of inhibition mechanisms
5. explain the binding principles based on Langmuir binding isotherm
6. understand how allosteric enzymes work
7. explain different types of reaction mechanisms, active site determination and principles of enzyme assay
8. communicate scientific knowledge in different forms effectively and appropriately
9. have conscientious in their academic and professional conduct, able to work with other, and respect others' opinions

109703 Protein Structure and Engineering

4(4-0-8)

Prerequisite : 109700 Graduate Biochemistry /Consent of the School

Basic review of the structures and properties of amino acid peptide bonds, peptides, polypeptides & proteins, concepts for protein engineering, protein detection, purification and evaluation, electrophoresis, size determination, quaternary structure evaluation, protein primary structure determination, electronic structures and properties of amino acid residues and their reactivities, chemical synthesis of peptides & proteins; biological nucleic acid and protein synthesis & posttranslational modifications, Methods in genetic engineering of proteins, molecular evolution and the use of protein sequence alignment & analysis, physical basis of size and shape determination (e.g. diffusion, analytical centrifugation, light scattering, small angle X-ray scattering), spectroscopic evaluation of secondary structure and tertiary structure, protein structure determination by X-ray crystallography, NMR, & EM tomography, structural modeling and prediction, protein folding, protein interactions with ligands, proteins in membranes, student proposal on protein engineering.

Expected Learning Outcomes

On completion of this course, students are able to

1. explain principles of protein structure and the physical interactions involved in attaining protein structure
2. understand the basics of the methods and experiments used to study protein structure and structure-function relationships
3. evaluate and analyze scientific papers on protein structure and engineering and evaluate the quality of the data
4. have a basic understanding of the methods used to engineer proteins and to evaluate the effects of such engineering
5. have conscientious in their academic and professional conduct, and able to work with others
6. communicate scientific knowledge appropriately and effectively
7. Students are eager for knowledge and learning

109704 Nucleic Acids and Recombinant DNA Technology 4(4-0-8)

Prerequisite: Consent of the School

Structure and function of nucleic acid (including DNA and RNA) in both prokaryotes and eukaryotes, flow of genetic information, gene regulation, recombinant DNA technology, gene cloning, polymerase chain reaction (PCR), hybridization of DNA or RNA, genomic and cDNA libraries, DNA sequencing, gene expression profiles, RNA interference, and mutagenesis.

Expected Learning Outcomes

On completion of this course, students are able to

1. explain structure and function of nucleic acid in both prokaryote and eukaryote
2. explain the process of gene regulation in both prokaryote and eukaryote
3. recognize the technology for DNA and RNA analysis
4. apply the knowledge for research works

109706 Biochemical Instrumentation

4(3-3-6)

Prerequisite : Consent of the School

Principles of chromatography, TLC, LC, HPLC, GC, GC-MS, LC-MS/MS, Spectroscopy: visible and UV spectroscopy, fluorescence spectroscopy, circular dichroism, nuclear magnetic resonance, flow cytometry, fluorescence activated cell sorting (FACs), X-ray crystal diffraction, dynamic light scattering spectroscopy, isothermal microcalorimetry, DNA and protein separation by electrophoresis, DNA sequencers, single channel measurements

Expected Learning Outcomes

On completion of this course, students are able to

1. explain principles of chromatographic separation of various types.
2. explain principles of various type of spectroscopy
3. explain principles of advanced instrument for biomolecular analysis
4. describe principles of electrophoretic separation
5. analyse and interpret result from each instrument correctly
6. appropriately choose the instrument for doing research

109707 Bioinformatics and Computer Usage

2(1-3-2)

Prerequisite : Consent of the School

Basic computing, operating systems, languages, basic UNIX commands, internet, searching principles, basics of molecular evolution, tools for nucleotide and protein sequence analysis, protein sequence alignment, database searching, multiple sequence alignment, tree generation and meaning, sequence and structure databases, display of macromolecular structural models.

Expected Learning Outcomes

On completion of this course, students are able to

1. explain principles of bioinformatics.
2. have skill in using computers and computer programs in conducting biochemical evaluations
3. collect, classify, store, evaluate and analyze scientific data
4. conscious and aware of the academic and professional conduct, and are able to work with others
5. communicate scientific knowledge in different forms effectively and appropriately
6. eager for knowledge and learning of Bioinformatics and Computer Usage

109707 Selected Research Project

4(0-12-0)

Prerequisite : 109700 Graduate Biochemistry/Consent of the School

Develop skills in the use of biochemical methods in scientific research, writing and present a research proposal in coordination with their class advisor, conduct the small biochemical research project, report and present the results in a seminar to the biochemistry faculty academic staff and students.

Expected Learning Outcomes

Students understand the research problem; have ability to conduct a literature review on relevant documents; and understand theories, key concepts and instrument. Students have basic skills to conduct the project, ability to analyze, discuss and conclude the obtained data. Finally, students are able to write a scientific report and present the obtained results systematically.

109711 Principles of Transport across Membranes

2(2-0-4)

Prerequisite : Consent of the School

Properties of biological membranes and types of membrane proteins, biophysics and kinetics of various types of molecular transports across membranes of prokaryotic and eukaryotic cells, types of membrane proteins involving signal transduction, fundamental methods for studying structures and function of membrane proteins, defects in membrane transport which lead to genetic diseases, mechanisms of multi-drug resistance involving transport across membranes

Expected Learning Outcomes

On completion of this course, students are able to

1. Explain properties of biological membranes and types of membrane proteins

2. Explain principles of molecular transports across membranes
3. Explain fundamental methods for studying membrane proteins

109721 Advanced Bioinformatics and Biochemical Computing **3(3-0-6)**

Prerequisite : 109705 Bioinformatics and Computer Usage

Computer programs and programming concepts, molecular evolution and biological sequences sequence alignment strategies and implementation, structural analysis of proteins and molecular modeling, analysis of other types of biological/biochemical data.

Expected Learning Outcomes

On completion of this course, students are able to

1. Understand the general structure and utilization of public databases.
2. Utilize tools for analysis of protein and nucleic acid sequences.
3. Understand and explain basic approaches to designing and implementing simple scripts related to biochemical data and processing.
4. Understand the structure of protein structure files and utilize graphics software to analyse protein structures.
5. Utilize basic mRNA expression analysis programs and websites.

109724 Genomics, Functional Genomics **3(3-0-6)**

Prerequisite : 109700 Graduate Biochemistry/109705 Bioinformatics and Computer Usage/Consent of the School

Definition of genomics, genome and genome components, DNA sequence in human genome, genetic variation in human genome (mutation and SNPs), genomics study with high throughput technology in DNA levels (Exome re-sequencing), transcription profiling (cDNA microarray, SAGE, EST, and real time RT-PCR), functional study for interested gene with mutagenesis and RNA interference; RNAi, and its applications disease and medical application.

Expected Learning Outcomes

On completion of this course, students are able to

1. explain the basic ways to analyse genomic data for gene expression and function
2. explain the origin and use of gene expression data in the public databases
3. explain the use of SNPs and other genomic polymorphisms

109731 Clinical Biochemistry **3(3-0-6)**

Prerequisite: 109700 Graduate Biochemistry/Consent of the School

Cause of inherited and non-inherited metabolic disorders, cause of abnormal quality and quantity of macromolecules or body fluid in the body, pathogenesis of

biochemical disorders, biochemical analysis for diagnosis and monitoring.

Expected Learning Outcomes

On completion of this course, students are able to

1. recognize the biochemical disorders
2. explain the causes and mechanisms of the disease
3. explain and interpret the result from biochemical analysis.

109732 Biochemical Immunology

4(4-0-8)

Prerequisite: Consent of the School

Basic knowledge of biochemical mechanism of the immune system, nature and properties of immunological molecules, mechanism of host defense, principal mechanism of the immune responses, recognition of foreigner pathogens, activation of immunological cells, related diseases of failure defense mechanism, evolution of immunological technology in scientific area.

Expected Learning Outcome

On completion of this course, students are able to

1. identify type and function of cells or molecules, which play important role in the immune system
2. describe the mechanism of the immune system
3. explain the defect that caused by the failure of the immune system
4. search, interpret, and evaluate information from literatures
5. apply the knowledge about the immune system for scientific works

109733 Biochemistry and Molecular Biology of Cancers

4(4-0-8)

Prerequisite: 109700 Graduate Biochemistry/Consent of the School

Definition of cancer cells, multistep carcinogenesis, cancer cell metabolism, cell cycle and regulation, oncogenes, tumor suppressor genes, genomic stability and DNA repair, cancer signaling pathways, cell death, cancer invasion and metastasis, cancer epigenetics.

Expected Learning Outcomes

On completion of this course, students are able to

1. explain the process of cancer development
2. differentiate the functional role between oncogenes and tumor suppressor genes
3. explain the molecular biology of cancer cell growth and cancer cell survival
4. apply the knowledge for research work

109734 Biochemistry for Healthcare Products and Cosmeceuticals

4(4-0-8)

Prerequisite: 109310 Principles of Biochemistry II, 109700 Graduate Biochemistry /Consent of the School

Background about biochemistry, physiology and morphology of epidermis connective tissue, hair teeth body liquids, types and active

ingredients of healthcare and cosmeceutical products, uptake, transportation, functions and metabolism of healthcare and cosmeceutical products, clinical biochemistry of healthcare and cosmeceutical products, industry of healthcare and cosmeceutical products

Expected Learning Outcomes

On completion of this course, students are able to

1. understand and are able to explain principles of biochemistry metabolism and function of healthcare products and cosmeceuticals
2. know about types, components, and active ingredients of for healthcare products and Cosmeceuticals
3. eager for knowledge and learning of biochemistry for healthcare products and cosmeceuticals

109735 Formulation and Analysis of Healthcare and Cosmeceutical Products

4(2-6-4)

Lecture and Laboratory studies general principles about formulation, Analysis of chemical propeerties, physical propeerties, and biological propeerties quality safety-test, quality trest of healthcare and cosmeceuticals products

Expected Learning Outcomes

On completion of this course, students are able to

1. explain principles of healthcare and cosmeceuticals products
2. have skill in using scientific instruments and in conducting biochemistry experiments.
3. collect, classify, store, evaluate and analyse scientific data.
4. conscious and aware of the academic and professional conduct, and are able to work with others.
5. communicate scientific knowledge in different forms effectively and appropriately.
6. eager for knowledge, learning for healthcare and cosmeceuticals products

109741 Plant Biochemistry

4(4-0-8)

Prerequisite: Consent of the School

Biochemistry and basic physiology of plant such as photosynthesis and respiration, the biochemistry of intermediary metabolism and the secondary plant compounds, bioenergetics, hormone regulation of metabolism and application.

Expected Learning Outcomes

On completion of this course, students are able to

1. explain the biochemistry and physiology of plants
2. compare the biochemistry between plants and other living organisms.
3. explain how to apply to use the plant biochemistry knowledge in the fields of scientific researches and industries

109742 Plant Secondary Metabolism and Application

4(4-0-8)

Prerequisite: None

Major of plant secondary metabolites, biosynthesis, function, metabolic control, application in industry, ecology and medical treatment, metabolic engineering.

Expected Learning Outcomes

On completion of this course, students are able to

1. classify the plant secondary metabolites and explain their functions
2. explain how to apply to use the plant secondary metabolite knowledge in the fields of scientific researches, industries and ecology

109743 Microbial Biochemistry

4(4-0-8)

Prerequisite : 109700 Graduate Biochemistry/Consent of the School

This course involves biochemistry and basic physiology of archaea, bacteria and viruses such as growth (reproduction or multiplication), structures, functions and synthesis of cell wall and cell membrane, encapsidation and envelope formation of viruses, regulation of metabolism and genetic transferred, bioenergetics, chemical communication of bacteria, materials uptake and secretion of bacteria, enter to and exit form host cell, pros, cons and applications.

Expected Learning Outcomes

On completion of this course, students are able to

1. explain principles of microbial biochemistry
2. have skill in using scientific instruments and in conducting microbial biochemistry experiments
3. eager for knowledge and learning of microbial biochemistry

109752 Antibody Technology

3(3-0-6)

Prerequisite: 109732 Biochemical Immunology/Consent of the School

Basic knowledge on biochemical structure, function, and production of antibody, evolution of antibody engineering and application, using of antibody in scientific area.

Expected Learning Outcomes

On completion of this course, students are able to

1. describe biochemical structure and function of the antibody
2. describe antibody production and type of the antibody
3. describe the suitable handling of the antibody for scientific works
4. explain evolution of antibody for research and therapeutic application
5. apply knowledge about antibody technology for research effectively and appropriately

109771 Current Topics in Biochemistry

3(3-0-6)

Prerequisite: 109700 Graduate Biochemistry/Consent of the School

Current topics of interest in Biochemistry and Biochemical technology.

Expected Learning Outcomes

On completion of this course, students are able to

1. describe the important of the interested current topics in biochemistry and biochemical technology
2. describe the theory about the current topics in biochemistry and biochemical technology
3. search, interpret, and evaluate information from literatures effectively and appropriately
4. update their knowledge about current topics in biochemistry and biochemical technology
5. apply the novel knowledge for research work effectively and appropriately

**109775 Principles of Macromolecular Crystallography
and Small Angle X-ray Scattering 4(4-0-8)**

Prerequisite : 109703 Protein Structure and Engineering/Consent of the School

Theory of macromolecular crystallography, indirect nature of macromolecular crystal structures, overview of protein and amino acid X-ray crystal structure determination and its requirements, preparation of protein for crystallography, including introduction of selenomethionine; generation of protein crystals, introducing ligands and heavy atoms; diffraction, Fourier transform and its relation to diffraction and structure generation; indexing and scaling crystal data, indications of data quality, crystal symmetry and systematic absences; phasing of crystal structure factors, structure solution, refinement; structural convergence, measures of structure quality, evaluating published crystal data, other diffraction methods: fiber diffraction, X-ray scattering, electron diffraction, neutron diffraction, processing of EM images. Principles of small angle X-ray scattering in determining solution structure of protein and others macromolecules.

Expected Learning Outcomes

On completion of this course, students are able to

1. explain principles of macromolecular crystallography and small angle X-ray scattering
2. eager for knowledge and learning of macromolecular crystallography and small angle X-ray scattering

**109776 Practical in Protein Crystallography
and Small Angle X-ray Scattering 4(1-9-2)**

Prerequisite: 109703 Protein Structure and Engineering/Consent of the School

Laboratory class in small angle X-ray Scattering and protein crystallography techniques, protein purification and evaluation, protein crystallization exercise, protein crystal seeding, crystal inspection and evaluation, crystal diffraction, data processing, structure solution by molecular replacement, software for other phasing methods, structure refinement with CCP4 or Phenix, etc., Evaluation of structures on internet servers, i.e. Procheck, Molprobit, etc.

Expected Learning Outcomes

On completion of this course, students are able to

1. explain principles of macromolecular crystallography and small angle X-ray scattering
2. have skill in using scientific instruments and in conducting macromolecular crystallography experiments and small angle X-ray scattering
3. collect, classify, store, evaluate and analyze scientific data.
4. be conscious and aware of the academic and professional conduct, and to work with others

5. communicate scientific knowledge in different forms, efficiently and appropriately
6. desire knowledge and learning of macromolecular crystallography and small angle X-ray scattering

Seminar classes

109881 Biochemistry Seminar I

1(0-1-2)

Prerequisite: None.

Selecting topics or issues, planning seminars in advance Biochemistry, presentation, discussion, clarifying for questions related to recently research publication in the filed of interest

Expected Learning Outcomes

On completion of this course, students are able to

1. improve scientific reading skills, identify main content and interpret the result of selecting article
2. enhance scientific communication skills through discussions, small-group work, presentations or debates
3. improve critical thinking skill

109882 Biochemistry Seminar II

1(0-1-2)

Prerequisite: None

Selecting topics or issues, planning seminars in advanced Biochemistry, presentation, discussion, clarifying for questions related to recent research publications in the field of interest

Expected Learning Outcomes

On completion of this course, students are able to

1. improve their scientific reading skills, identify main content and interpret the results of selected articles
2. interpret and effectively review the literature, and write the scientific review
3. enhance scientific communication skills through discussions, small-group work, presentations or debates
4. Have conscientious in their academic and professional conduct, be able to work with other, and respect others' opinions
5. improve critical thinking skills
6. present research work to the public

109883 Biochemistry Seminar III 1(0-1-2)

Prerequisite: None

Selecting topics or issues, planning seminars in advance Biochemistry, presentation, discussion, clarifying for questions related to recently research publication in the filed of interest

Expected Learning Outcomes

On completion of this course, students are able to

1. enhance scientific communication skills through discussions, small-group work, presentations or debates
2. improve critical thinking skill
3. enhance scientific communication skills through discussions, small-group work, presentations or debates

4. conscientious in their academic and professional conduct, able to work with other, and respect others opinions improve critical thinking skill
5. present the research work to the public in both national and international community

109884 Biochemistry Seminar IV 1.(0-1-2)

Prerequisite: None

Selecting topics or issues, planning seminars in advance Biochemistry, presentation, discussion, clarifying for questions related to recently research publication in the field of interest

Expected Learning Outcomes

On completion of this course, students are able to

1. enhance scientific communication skills through discussions, small-group work, presentations or debates
2. improve critical thinking skill
3. have conscientious in their academic and professional conduct, able to work with other, and respect others opinions
3. present the research work to the public in both national and international community

Thesis Courses:

109791 M.Sc. Thesis

Prerequisite : Consent of the School

Research and report writing on a specific topic relevant to the field of interest in Biochemistry under the supervision of the thesis advisory committee.

On completion of this course, students are able to perform literature searches, conduct and present research relevant to biochemistry, improve existing knowledge or develop a new one.

Students are also able to write a final report and pass an oral examination.

109891 Ph.D. Thesis

Prerequisite : Consent of the School

Creating hypothesis, thesis proposal writing, research, science interpretation data, and report writing on a specific topic relevant to the field of interest in Biochemistry and Biochemical Technology under the supervision of the thesis advisory committee.

On completion of this course, students are able to

Students are able to perform literature search, conduct and present a research relevant to Biochemistry and Biochemical Technology, improve existing knowledge or develop a new one.

Students are also able to write a final report and pass an oral examination.