- **Program's General Structure:**
  - **Thesis with some Courses Option**

The required study units are 19 study hours in addition to 24 study hours for the thesis as shown in the following table:

Type of Courses	No. of Courses	No. of Units Required
Core Courses	9	(16) study hours
Elective Courses	5	(3) study hours
Comprehensive Exam	1	(0)
Thesis	1	(24) study hours
Total	**16**	**(19) study units + (24) study units for thesis**

Program's Study Plan:

❖ **First Level**

#	Course Code	Name	No. of Study Units	Prerequisite Course
1	BCH601	Advances in applied biochemistry	2 (2+0)	
2	BCH602	Advanced bioanalytical techniques	2 (2+0)	
3	BCH603	Recent aspects of molecular genetics	2 (2+0)	
4	BCH604	Advanced topics in biochemical research	2 (2+0)	
5	BCH605	Bioethics	1 (1+0)	
Total			**9 study units**	

❖ **Second Level**

#	Course Code	Name	No. of Study Units	Prerequisite Course
1	BCH606	Advances in genomics and bioinformatics	2 (2+0)	
2	BCH607	Advanced topics in metabolism	2 (2+0)	
3	BCH608	Biochemical and protein engineering	2 (2+0)	
4	BCH699	Thesis proposal preparation	One study unit	(9) study units
5	BCH …	Elective Course (1)	1 (1+0)	
6	BCH …	Elective Course (2)	2 (2+0)	
Total			**10 study units**	

❖ **Elective Courses: Student selects only two courses with a total of 3 study units**

#	Course Code	Name	No. of Study Units	Prerequisite Course
1	BCH609	Bionanotechnology	2 (2+0)	
2	BCH610	Genetic manipulations and therapy	2 (2+0)	
3	BCH611	Recent aspects in biochemical cell signaling	2 (2+0)	
4	BCH612	Biochemical data analysis	1 (1+0)	
5	BCH613	Seminars in biochemistry	1 (1+0)	

❖ **Third Level:**

#	Course Code	Name	No. of Study Units	Prerequisite Course
1	Com700	Comprehensive Exam	0	(19) study units

❖ **Fourth Level**

#	Course Code	Name	No. of Study Units	Prerequisite Course
1	BCH700	Thesis	(24) study units	BCH699, Com700
Total			**(19) study units + (24) study units for thesis**	

- **Description of Courses:**

BCH601	**Advances in applied biochemistry**	**2(2+0)**
Methods and techniques associated with biomolecule separation and purification. Biochemical sensor design, biochemical fuel cell applications, bioremediation and biodegradation. Industrial carbohydrate applications. Eicosanoids, heat shock proteins and interferons identification. Applications of enzyme immobilization. Biomolecular electrode technology.		
BCH602	**Advanced bioanalytical techniques**	**2(2+0)**
Biochemical methods used in next generation sequencing, 3D imaging, protein crystallization, macromolecule engineering, large scale production and stabilization of recombinant protein, protein PEGylation, circular dichroism, Any new technique invented in the field of biochemical research that evaluated structure- function relationships will be included.		
BCH603	**Recent aspects of molecular genetics**	**2(2+0)**
Nucleic acid structure and topology, genome structure and its stability, the regulation of gene expression at the levels of transcription, post-transcriptional processing, translation, post-translational modification; DNA damage, mutagenesis and repair. Transposons and site-specific recombination and recombinant DNA technology and genetic engineering with their applications.		
BCH604	**Advanced topics in biochemical research**	**2(2+0)**
Recent aspects in peptides, proteins structure, enzyme function, carbohydrate metabolism, lipid metabolism, oxidative phosphorylation, photosynthesis and carbon fixation, nitrogen metabolism, integration of metabolism, nucleic acids, replication, transcription, immunology and cancer biochemistry.		
BCH605	**Bioethics**	**1(1+0)**
Scientific integrity and compliance with regulations for laboratory research. Ethical issues in life science. Principles of bioethics and technology. Recognize and compare biochemistry (science) and ethics (philosophy). Bioethical problems. Provide rational justification for ethical decisions.		
BCH606	**Advances in genomics and bioinformatics**	**2(2+0)**
Human molecular genetics, whole genome alignment, next generation sequencing data, comparative genomics, phylogenetic, biological database, system biology, simple Mendelian diseases, complex diseases, functional genomics, population genetics, epigenetics, SNPs, copy number and structural variations, personal and clinical genomics, cancer genomics. Metagenomics and metatranscriptomics.		
BCH607	**Recent advances in metabolism**	**2(2+0)**
Pathways of intermediary and secondary metabolism. Regulation of these pathways. Relation between human diseases and metabolic pathways. Role of nutrition in the prevention and treatment of disease. Metabolism of vitamins and minerals. Unusual pathways of metabolism. Detailed nucleotides and amino acids metabolism. Integration of metabolic systems. Electrolyte and fluid balance.		
BCH608	**Biochemical and protein engineering**	**2(2+0)**

Concepts of biochemical and protein engineering and their applications. Compare amino acid sequence and structure of proteins, and relate this information to the function of proteins. Techniques used for creating and modifying the structure of biomolecules. Protein and biocatalyst engineering. Models of biologically engineered enzymes. Tissue engineering.		
BCH609	**Bionanotechnology**	**2(2+0)**
Techniques and concepts used in bionanotechnology. Characterization of biomaterials and development of bionanotechnology-based devices. Implementation of bionanotechnology in toxicology, cancer biology, life sciences, biochemistry, DNA sequencing and delivering biomolecules to target cells.		
BCH610	**Genetic manipulations and therapy**	**2(2+0)**
Gene manipulation in the Post-Genomics Era. Cutting and joining DNA molecules. Plasmids, phage and cosmids cloning strategies. Site-directed mutagenesis, manipulating DNA in different living organisms (bacteria, yeast, fungi and animal cells), advanced transgenic technology. Applications of gene manipulation in practical life.		
BCH611	**Recent aspects in biochemical cell signaling**	**2(2+0)**
Membrane transport. Cell communication. Signal transduction through receptor activation, and the generation of second messengers. Ion channel functions. Cell signaling and apoptosis. Different receptors families: e.g., protein kinases, growth factor receptors, G-proteins, Phospholipase and Phosphoinositide 3-Kinase, insulin receptor, and nuclear receptors.		
BCH612	**Biochemical data analysis**	**1(1+0)**
Mathematical biology concepts. Tools for describing and summarizing data; inference methods on population means and proportions; statistical hypothesis testing; group comparisons; simple linear regression; categorical data analysis; power and sample size in study designs.		
BCH613	**Seminars in biochemistry**	**1(1+0)**
Practice in preparing and presenting an oral presentation of any recent research in biochemistry. Explaining used techniques. Integrate various pieces of knowledge that has obtained. Ability to answer wide aspects of questions. Ability to participate in group discussions.		
BCH699	**Prepare a search plan**	**1(1+0)**
Instructing the student to select the subject of the thesis and identify the research problem, and help in preparing the research plan for the research point chosen according to the general framework of the research plan**.**		
BCH700	**Thesis**	**1(1+0)**
The research plan for the PhD thesis is implemented. Where students first work on designing a plan to manage and analyze the problem in question. And then perform laboratory experiments to devise the next step in the research. At each stage of the research, a detailed discussion with the faculty supervisor of the thesis will be carried out to guide the student in the selection of ways to analyze the results of the research, critique it and how to display and publish.		