ISTINYE UNIVERSITY
FACULTY OF PGARMACY, PHARMACEUTICAL CHEMISTRY
DOCTORATE PROGRAM COURSE DESCRIPTION

1th SEMESTER

Advanced Organic Chemistry-I ECTS (2+0) 7

In order to take this course, ECZ211 / PHAR211 Organic Chemistry or any equivalent organic chemistry course must be passed. Within the scope of this course, students will be able to use advanced chemical bonding structures and molecular orbitals; stereochemical principles; conformational, steric and stereoelectronic effects in organic chemistry; nucleophilic substitution reactions; polar addition and elimination reactions, carbanions and reactions of other nucleophilic carbon species; reactions of carbonyl compounds.

Scientific Research Methods and Publication Ethics ECTS (1+0) 7

Within the scope of this course, students will learn about library facilities, online libraries, online databases, online drug and medicine libraries, American Chemical Society index scanning, Belstein index scanning, and the use of online organic synthesis libraries. Students will be taught international and national scientific article writing methods. Students will be taught methods of writing Tübitak projects. Students will be taught how to write and deliver scientific seminar presentations.

Elective Course (0+0) 8

Elective Course (0+0) 8

2th SEMESTER

Advanced Organic Chemistry-II ECTS (2+0) 7

Amines, Benzene and aromaticity**,** mechanism of aromatic electrophilic substitution reactions Nitration, sulphonation, halogenation, Friedel Crafts Reactions; nucleophilic aromatic substitution.

Seminar ECTS (1+0) 7

Students taking this course prepare and present a seminar on their own research topics. Students taking this course are required to attend weekly Faculty of Pharmacy seminars.

Elective Course ECTS (0+0) 8

Elective Course ECTS (0+0) 8

3th SEMESTER

Qualitative and Quantitative Analysis of Drugs ECTS (2+2) 6

In this course chemical and ınstrumental methods used for pharmaceutical analysis will be given as well as impurity testing, pharmacopea methods, analytical method development, validation of analytical methods.

Elective Course ECTS (0+0) 8

Elective Course ECTS (0+0) 8

Elective Course ECTS (0+0) 8

4th SEMESTER

Preperation for Prelim ECTS (0+0) 30

5th SEMESTER

Preperation for Prelim ECTS (0+0) 0

Thesis Proposal ECTS (0+0) 50

6th SEMESTER

Thesis ECTS (0+0) 130

7th SEMESTER

Thesis ECTS (0+0) 130

8th SEMESTER

Thesis ECTS (0+0) 130

AREA ELECTIVE COURSES

Advanced Pharmaceutical Chemistry ECTS (2+2) 8

Drug Discovery Process, Enzyme Inhibition, Proteases, Receptors, Ion Channels, Lead Compound, Lead Compound Optimization, Physicochemical properties in drug development, Toxicity in drug development.

Literature Search and Presentation ECTS (0+2) 8

Within the scope of this course, students will be given research topics within the scope of Pharmaceutical Chemistry. They will prepare and present a presentation by conducting scientific research / library research on students' topics.

Organic Drug Synthesis ECTS (2+0) 8

Introduction, Design of Synthesis, Sinton Approach, Retro-Synthetic Approach, Reaction specificity, Variables of Reactions, Structural Variables, Functional group transformations, Elimination of functional groups, Fragmentation, Protective groups, Stereochemistry.

Computational Drug Design and Development (Theoretical) ECTS (2+0) 8

In this course, Pharmaceutical Chemistry students will be told the theory of drug development methods. Information will be given about log-P calculation, structure-activity relationships, definition of factors affecting receptor-drug binding, pharmacofor determination, DOCK theory and working principles, Virtual Screening method, energy calculations, Molecular Dynamics methods and theories of binding energy calculation methods.

Computer Assisted Drug Development (Application) ECTS (0+2) 8

Within the scope of this course, students will be able to practice LogP, Q-SAR, structure coordinate files, molecular imaging programs, molecular docking, virtual screening,

pharmacophore determination, molecular dynamic calculation, binding constant calculation, homology modeling calculation in 3D-in-silico laboratory. The main aim of this practical course is to bring graduate Pharmaceutical Chemistry students to a level that can design new drug synthesizable candidate molecules.

Organic Chemistry Synthesis Methods (Application) ECTS (0+2) 8

In order to take this course, ECZ211 / PCM211 Organic Chemistry or an equivalent organic chemistry course is required. Students taking this course learn laboratory techniques in organic chemistry (rotary evaporator, filtration, extraction, reaction mechanisms, etc.), organic substance synthesis and instrumental characterization (melting point determination, Ft-IR, NMR, Mass spectroscopy etc.) methods.

Pharmaceutical / Compound Purification Methods ECTS (1+2) 8

Students taking this course, rotary evaporator, distillation, crystallization, extraction methods (soxlet, simple, etc.), chromatographic separation methods (thin layer chromatography, column chromatography, high pressure liquid chromatography (HPLC), etc.) used in the purification of new compounds synthesized in Pharmaceutical Chemistry laboratories. Have information about HPLC columns (reverse-phase, flat-phase, ion-exchange, chiral).

Heterocyclic Compound Chemistry ECTS (2+0) 8

Introduction, definition and classification, synthesis of heterocyclic compounds, properties and applications.

Heterocyclic Compound Chemistry (Application) ECTS (0+2) 8

Synthesis applications for heterocyclic compounds

Bioorganic Chemistry ECTS (2+0) 8

Introduction to bioorganic chemistry, definitions, chemistry of biomimetics, enzyme models, weak bonds in chemistry and biology, proximity effect and molecular recognition, similarity of biochemical and organic reactions, bioorganic chemistry of amino acids, enzymes and nucleic acids.

Three Dimensional NMR Structure Determination of Drugs and Biomolecules ECTS (1+2) 8

Advanced NMR data analysis will be taught using the NMR program in this course. NMR concept and working method, NMR pulses and signal reception, NMR probes and functions, FID analysis and Fourier Transformation, visinal / geminal coupling frequencies and Karplus functions, negative / positive Nucleer Overhauser effect (NOE) and distance calculation, T1 and T2 analysis, Calculation of kinetic change constant (kon / koff), gHMBC FID analysis and CH coupling frequency determination, gDQF-COSY FID analysis and HH coupling frequency determination, NOESY-FID and ROESY-FID analysis and NOE measurements, NMR distance and angle information using AMBER program 3-dimensional structure analysis of synthetic and biomolecules by using, NMC method, determination of multicentric stereochemistry in compounds.

Bioinformatics and Personal Drug Design ECTS (1+2) 8

This course is a pharmacogenomic subject and aims to be a solution to the problem of drugs not being able to bind to different alleles and to design new drugs. In order for students to have prior knowledge of computational drug development techniques, FKM603 and FKM604 courses must be successfully completed in order to take this course. The use of bioinformatics databases, polymorphism in genes, determination of protein mutations caused by polymorphism, homology modeling, deployment of the drug with DOCK to different alleles and Molecular Dynamics calculations, MM-PBSA binding energy determination, ALA-SCAN mutation analysis, personal drug design.

Determination of Biological Activity of Drugs / Compounds ECTS (2+2) 8

It is a course that teaches techniques for measuring the biological activities of compounds, natural compounds and drugs synthesized in pharmaceutical chemistry laboratories. In this course, cancer cell inhibition of the compounds (IC_{50}), bacterial cell inhibition (MIC), enzyme inhibition, determination methods of anti-aging properties in *C. elegans* animal laboratory will be taught both theoretically and experimentally.

Mechanisms of Anticancer Drugs and Receptor-Drug Interactions ECTS (2+2) 8

Cancer and cancer gene expression pathways, cancer cell death pathways, antineoplastic drug groups and target receptors, chemotherapy resistance, alkylating anticancer drugs, metal complex anticancer drugs, antimetabolites, microtubule inhibitors, vinca alkaloids, taxanes, epipodophylotoxins, camptothecins, anticancer antibodies , hormone antagonists, tyrosine kinase inhibitors, growth factor receptor inhibitors and interaction mechanisms will be elucidated in this course. Practically experimental and computational drug-receptor binding studies and PCR gene expression studies will be performed.

Metabolism Reactions and Metabolites in Drug Design ECTS (2+0) 8

In this course, Biotransformation, Pro-drug, drug metabolism and kinetics, microsomal enzymes, Phase I reactions and metabolites of drugs, Phase-II reactions and metabolites of drugs, Monoaminoxidase reactions and metabolites of drugs, Flavinmonoxygenase reactions and metabolites of drugs, P450 enzyme regulators topics will be taught.

Biophysical Binding Properties of Receptor Targeted Drugs ECTS (1+2) 8

The students who take this course have both computational and binding binding properties (H-bond, electrostic forces, van der Waals forces), binding constants, thermodynamic properties (ΔG, ΔH, ΔS, ΔCp) of drugs that bind to receptors originating from DNA / RNA or protein. study will have knowledge in the stage of interpreting the experimental results (NMR, isothermal titration calorimetry, surface plasmon resonance, Differential Scanning Calorimetry, gel electrophoresis etc.).

Selected Topics in Pharmaceutical and Medicinal Chemistry – 1 ECTS (2+0) 8

It includes elective subjects in the field of Pharmaceutical Chemistry. This course will be opened when needed.

Selected Topics in Pharmaceutical and Medicinal Chemistry – 2 ECTS (2+0) 8

It includes elective subjects in the field of Pharmaceutical Chemistry. This course will be opened when needed.

Selected Topics in Pharmaceutical and Medicinal Chemistry – 3 ECTS (2+0) 8

It includes elective subjects in the field of Pharmaceutical Chemistry. This course will be opened when needed.

Selected Topics in Pharmaceutical and Medicinal Chemistry – 4 ECTS (2+0) 8

It includes elective subjects in the field of Pharmaceutical Chemistry. This course will be opened when needed.

Controlled Release, Drug Delivery Systems and Chemistry ECTS (2+0) 8

Introduction to controlled release systems, transport mechanisms in controlled release systems, biomethers used in new and modern drug delivery systems as carriers, micro and nano particle systems, micro capsules, nanoparticles, liposomes, micelles and reverse micelles, transdermal drug delivery systems, peptide, protein and gene delivery systems, implant drug delivery systems, microneedle and microchip technologies, gene therapy, protein drug delivery systems.

Introduction to Computer in Pharmaceutical Chemistry (Theoretical) ECTS (2+0) 8

BASH and CSH programming languages walking under Linux Operating System used in Drug Development, Graphical Presentations, Basic Windows Commands, Remote VPN access, Secure Shell, Secure Copy, Basic Windows Operating System Commands.

Introduction to Computer in Pharmaceutical Chemistry (Application) ECTS (0+2) 8

Programming applications on Linux and Windows Operating Systems

Pharmaceutical/Medicinal Chemistry-I ECTS (3+0) 8

Drug Metabolism: Phase-1 And Phase-2 Reactions; CNS Drugs: Cholinergic ang Adrenergic Agents, Anesthetic Agents, General and Local Anesthetics, Antipsychotic and Anxiolytic Drugs, Sedative-Hypnotics, Antidepressants, Antiseizure Agents; Cardivascular Agents,

Pharmaceutical/Medicinal Chemistry-II ECTS (3+0) 8

Chemotherapeutics, Antihyperlipidemics, anticoagulant, antiplatelet agents anfibrinolysis agents; Antidiabetic agents; Hormones; Nonsteroidal Antiinflammatory Drugs; Antihistaminic agents; Chemotherapeutic Agents.

SCIENTIFIC PREPARATORY COURSES

Basics of Pharmacology ECTS (2+0)

Pharmacological and pharmacodynamic properties of drugs, autonomic drugs, central nervous system drugs, chemotherapeutic drugs, antidiabetic drugs, antihypertensive drugs, antihyperlipidemic drugs, antiinflammatory drugs will be explained in this pharmacology course, which is adapted for students who are not pharmacists and accepted to the integrated doctoral program.

Principles of Pharmaceutical Chemistry ECTS (2+2)

This course covers the basics of Pharmaceutical Chemistry, especially for doctoral students who are not graduates of a pharmacy. Within the scope of this course, factors in the interaction of synthetic or natural drugs with receptors, antagonist / agonist / reverse-agonist drugs, receptor types (7-TM receptors, ion channels, enzymatic receptors, hormone receptors, etc.), in-silico drug design, effect of basic drug groups covers mechanisms and organic synthesis.

General Chemistry ECTS (2+2)

Chemical Nomenclature

At the end of this course, the student will be able to explain the structure of inorganic, organic and coordination compounds using IUPAC rules. This course provides the student with the necessary background to understand the chemistry of compounds and to analyze their structures by recognizing basic functional groups. In this course, the chemical properties of the compounds, the type of binding, the state of hybridization and the effect of the structure on the physical properties of the chemical compounds are also discussed.

Organic Chemistry ECTS (2+2)

Organic Chemistry Reaction Mechanisms

Definition and classification of organic reactions, Acidity-Basicity, Substitution Reactions: Nucleophilic Substitution Reactions, Electrophilic Substitution Reactions, Addition Reactions, Elimination Reactions, Conversion Reactions.

Instrumental and Spectroscopic Characterization of Drugs

Students taking this course are NMR spectroscopy (1H, 13C, COSY, DQF-COSY, DEPT, TOCSY, HSQC, HMBC, NOESY, ROESY), Mass spectroscopy (GC-MS, LC-MS, used in instrumental characterization of new compounds synthesized in Pharmaceutical Chemistry laboratories. Gains knowledge of LC-MSMS, MS, MS-FAB, MS-MALDI, MALDI-TOF, MS-EI), FT-IR, UV / Fluorescence / Visible spectroscopy, elemental analysis method and interpretation of their experimental results.

Biology, Molecular Biology and Genetics ECTS (2)

The aim of the course is to teach the structure and functioning of the cells at the molecular and genetic levels. The scope of this course; To teach structure and function of cell organelles, structure and function of chromosome, DNA and RNA molecules. In addition, understanding the basic molecular genetic mechanisms, cell cycle, cell death.

Pharmaceutical Microbiology ECTS (2)

In this course the characteristics of microorganisms that cause infection in humans, the diseases caused by these microorganisms and microbiological methods used in the diagnosis of these diseases will be examined. The production of antimicrobial agents and products of microbial origin includes issues such as quality control and use, as well as sterilization-disinfection methods and general hygiene.

Pharmaceutical / Medicinal Biochemistry ECTS (2)

This course covers fundamental biochemical topics (i.e. receptors, enzymes, nucleic acids) that direct the discovery, design and development of new drug candidates for the prevention, diagnosis and treatment of diseases; because human health is rooted in its biology, its biology is based on chemistry/biochemistry. The interactions of selected drugs with target biomolecules and changes that occur due to these interactions will be emphasized.

****Term Project**

It is a project course that students should take at the request of their advisor. This course can be taken for more than one semester during the doctoral program. Students who take this course research with their advisors on the doctorate topics they determine.

****Field Application**

It contains specific study topics in the field of Pharmaceutical Chemistry. This course will be opened when needed.