Course description

Semester 1

1) **Basic Pharmaceutical Chemistry (FAF 111)**
   Basic Pharmaceutical Chemistry provides lessons on the definition, scope, benefit of Basic Chemistry for pharmacists, chemistry and its role as the part of natural sciences, periodic table, atom, molecules and ions, colloids, chemical equilibrium, matter: gas, liquid, solid; intermolecular force, chemical bonds, acids and bases, physical properties of solutions, mixtures and solutions, chemical reaction in aqueous solutions, redox reactions, and the principles of electrochemistry.
2) **Basic Organic Chemistry (FAF 112)**
   Basic Organic Chemistry consists of the basics of organic chemistry, bonds and molecular structure, physical and chemical properties of organic compounds, stereochemistry and conformations, also basic reactions of organic compounds.
3) **Cell Biology (FAF 113)**
   Cell Biology is designed to help students understand the development history on cell theory, cell organizations, and proteins as a macromolecules of cells, biological process including anabolism and catabolism, type of signaling, intracellular receptors, cell surface receptors, initiation of intracellular signaling and signal amplifications, transport systems (active and passive), basics of gene expression, structure and function of plasmid in genetical engineering process, and principles of recombinant products engineering in pharmaceutical field.
4) **Human Anatomy and Physiology (FAF 114)**
   Human Anatomy and Physiology consists of structures and normal functions in body systems, such as nervous systems, respiratory system, circulation system, digestive system, excretion system, locomotor system, hematopoetic system, skin system, sensing system, endocrinal glands, mechanism of function controlling of those systems.
5) **Basic Microbiology (FAF 115)**
   Basic Microbiology consists of history of microbiology and its relationship with pharmacy, phylogenetic study, classification and identification of microorganism, biological characteristics of microorganism (bacteria, fungi, virus, and protozoa), growth and microorganism growth, including antibiosis and antisepsis concepts, mechanism of action, test of activity and resistance of antimicrobial compounds, basics of infectious disease, mechanism of microorganism pathogenicity.
6) **Introduction to Pharmaceutical Science and Ethics (FAF 116)**
   This course consists of introduction, pharmacist as a profession, pharmaceutical higher education in Indonesia, pharmaceutical services and competencies, pharmacy and its development, drugs and drug development, drug pharmacokinetic, pharmaceutical dosage form and its design, bioavailability and

bioequivalence and drug registration, drug pricing structure and drug distribution, industrial pharmacy, hospital pharmacy, governmental pharmacy, and traditional medicines.

7) Physical Chemistry (FAF 117)

This course explains basic concepts of Physical Chemistry, e.g. application of scales, measurement tools and units used for preparing pharmaceutical dosage forms and calculating drug doses based on patients' body weight, knowledge on matters, ideal gases and real gases which are related to pharmaceutical dosage forms, knowledge on thermodynamics and thermodynamic properties which are utilized in designing pharmaceutical dosage form.

8) Religion and Ethics (AND 113)

This course is a national compulsory course. The central explanation is more elaborated using *tawheed* approach (acknowledgement on the Oneness of God and incorporating values of *tawheed* in every aspects of life. The course is started by knowing the universe, humans as the *khalifah* in the Earth, religions in the world, why choosing Islam as religion, human need on religion, relationship between *'aqeedah* and *sharia*, concepts of justice and law supremacy in Islam, rights and duties, etc. This course will be closed by description of *akhlaq* values as the result of integration between *tawheed* values and all human activities as the servant of Allah.

9) Pancasila (AND 114)

This course consists of introduction, Pancasila in discourse, history of Indonesian nation, Pancasila as the foundation of the country, Pancasila as the ideology, Pancasila symbols, Pancasila as the philosophic system, Pancasila as the ethic system, and Implementation of Pancasila.

Semester 2

(1) Pharmaceutical Organic Chemistry (FAF 121)

This course provides lessons on functional group organic chemistry which consists of physical and chemical properties of organic compounds including methyl derived organic compounds, organic compounds with electrophilic carbon atoms (alcohol, alkyl halides, ether and epoxide, aldehyde and ketone, carboxylic acid and its derivates), organic compound with nucleophilic carbon atoms (alkane, alkene, alkyne and aromatic compounds), aliphatic-aromatic compounds: amine, amino acid, peptides, proteins, lipids, carbohydrate, and nucleic acid.

(2) Solid Physical Pharmacy (FAF 122)

This course provides lessons on characteristics of active pharmaceutical solid compounds, characterization of solid properties, effect of manufacturing process on solid properties of active pharmaceutical compounds, polymorphism phenomenon, basic properties of particles: density, porosity, particle size distribution, specific surface area of powder, flow properties, wettability, gas-solid adsorption, and water adsorbance of powders.

(3) Basic Analytical Chemistry (FAF 123)

This course consists of introduction, the importance of drug qualitative analysis, introduction on drug analysis, initial steps of drug identification, initial reactions, identification of (zat asal), identification of functional groups, identification of anions and cations of inorganic drug compounds, identification of organic drug compounds, introduction to balance and measuring equipments, gravimetry and volumetric analysis including acid-base titration, argentometry, complexometry, iodimetry and iodometry, permanganometry.

(4) Pharmaceutical Microbiology (FAF 124)

Pharmaceutical Microbiology consists of history of microbiology and its relationship with pharmacy, phylogenetic study, classification and identification of microorganism, biological characteristics of microorganism (bacteria, fungi, virus, and protozoa), growth and microorganism growth, including antibiosis and antisepsis concepts, mechanism of action, test of activity and resistance of antimicrobial compounds, basics of infectious disease, mechanism of microorganism pathogenicity.

(5) Pathophysiology (FAF 125)

This course supports students to understand common terminology in pathophysiology, epidemiology, etiology and risk factors, classification, pathophysiology, clinical manifestations, complication and analysis of diagnosis on disease or disorders on cellular physiology, neoplasia, central nervous system, psychiatry, cardiovascular, digestive system, respiratory system, excretion system, joint, hormone, and skin. This course also provides basis to pharmacology and pharmacotherapy, as well as medicinal chemistry.

(6) Pharmaceutical Botany (FAF 126)

This course consists of classification and grouping of high order plants, plant morphology, character and characteristics of plants, vegetative and generative organ of plants, anatomical structures and physiological process that occur in plant cells, development of plant (from embryo to mature), plant cell structure, organelles and ergastic compounds, plant tissue classification, plant metabolism and the role of enzymes, photosynthesis, photolysis reaction, CO_2 fixation, respiration, glycolysis, Kreb's cycle, natural product chemical compounds.

(7) Basic Pharmacology (FAF 127)

This course provides lessons on pharmacology in general including general mechanism of action of drug, various pharmaceutical dosage form, route of administrations, pharmacokinetics. Several specific drugs will be studies on their physiological actions, therapeutic effect and toxicity and interaction and incompatibility with other drugs.

(8) Pharmaceutical Mathematics (FAF 128)

In general, this course consists of introduction, the importance of mathematics in pharmaceutical science, basic concepts of mathematics including ratio, proportion, and percentage, exponential and logarithm, differential and integral and linear equation and the implementation in pharmaceutical field such as

determining drug concentration in a dosage form, calculation of drug shelf-life, degradation rate, elimination and drug dissolution and measurement of pharmacokinetic parameters using calculator and computer programs, and basic statistics on data analysis.

Semester 3

(1) Qualitative Pharmaceutical Chemistry (FAF 211)
This course provides drug identification of alkaloids, sulfonamides, barbitals, hormones, antibiotics, antihistamines, vitamins, and identification of drugs in biological samples.

(2) Biochemistry (FAF 212)
This course provides lessons on characteristics of biomolecules (lipids, carbohydrates, amino acids, proteins, nucleic acids, DNA and RNA) and their functions in life. Basic concepts of bioenergetics, metabolism of carbohydrates, lipids, proteins, and diseases due to metabolism disorders, role of vitamins as co-factor, enzyme function and properties.

(3) Immunology and Serology (FAF 213)
This course consists of introduction, immunogen and epitope, lymphocyte and lymphoid tissue, immunoglobulin, antigen-antibody reaction, complements, cytokines, hypersensitivity, HLA, immunologic tolerance, autoimmune, immunology of infections and cancer, organ transplantation, immunization, immunomodulation and immunodiagnosis.

(4) Natural Product Chemistry (FAF 214)
In this course, students will learn basic concepts of Natural Product Chemistry, including biosynthesis of primary metabolite compounds and secondary metabolite, phytochemical screening and phytopharmacology, phenolic, flavonoids, coumarine, quinones, lignin, and tannin.

(5) Physical Pharmacy (FAF 215)
This course consists of solid properties of pharmaceutical active ingredients, characterization of solid properties, impact of manufacturing process on solid properties of active pharmaceutical ingredients, polymorphism, basic properties of particles: density, flowing properties, wettability, gas-solid properties, and water adsorbance of powders.

(6) Compounding (FAF 216)
Basics of drugs, prescriptions, prescription screening, drug label, drug storage in pharmacy based on its classification, drug dosage, drug balance, Latin terminology and the abbreviations in prescription, powders, ointment, and pills.

(7) Pharmacology of Central Nervous Systems, Autonomous Nervous Systems and Cardiovascular (FAF 217)
Drugs affecting parasympathetic and sympathetic nervous system, central nervous system, cardiovascular and digestive system (indication, mechanism of action, dosage, adverse effects, toxicity, contraindication, and resistance).

Semester 4

(1) Quantitative Pharmaceutical Chemistry (FAF 221)

This course consists of quantitative analysis for determining the concentration of pharmaceutical compounds based on physical, chemical, physicochemical properties of the compound using gravimetry, volumetry, chromatography (gas chromatography, high performance liquid chromatography, densitometry thin layer chromatography), and spectrophotometry (UV Visible, Atomic Absorbance Spectrophotometry).

(2) Pharmaceutical Natural Product Chemistry (FAF 222)

In this course, students learn various structure, biosynthesis pathway, and physicochemical properties of polyketide, terpenoid/steroid, and alkaloids.

(3) Liquid and Semisolid Dosage Technology (FAF 223)

This course consists of liquid and semisolid dosage form design including principles of dosage form formulation, relationship of administration route and dosage form and steps of developing dosage form; pre-formulation, excipients, equipment systems in dosage form preparation; formulation; preparation; and dosage form evaluation, particularly liquid and semisolid dosage form.

(4) Pharmacognosy (FAF 224)

In this course, student learns natural source of drug (plants, animals, mineral), natural source in medication; crude drugs; extracts and pure compounds; crude drugs production; standardization and quality control of crude drugs and extract; good manufacturing practice for traditional medicine.

(5) Pharmacology of Anti Infection and Endocrine (FAF 225)

This course explains pathophysiology and pharmacotherapy of several infectious disease, endocrine disorders, adrenal gland disorders, pituitary gland disorders, and pharmacotherapy of hormone as contraception.

(6) Basic Medicinal Chemistry (FAF 226)

In this course, students learn chemical structure, normal body condition and the changes due to imbalances of neurotransmitters, hormone, enzymes, and other endogenous compounds, also due to viral, bacterial, and fungal invasion (disease state); interaction of drug/exogenous compounds with receptors and brings the body to normal physiologic condition; interaction of agents and metabolism process of microorganism invading host (DNA replication, DNA transcription, protein/enzyme transcription, enzymatic system inhibition); source of drugs/agents, analysis, SAR and QSAR, pharmacokinetic and pharmacodynamic aspects.

(8) Separation Method (FAF 227)

This course consists of various separation methods in terms of theories, concepts, instrumentation and application to obtain pure compound (solute) or qualitative and quantitative analytes from mixtures of biological matrices, natural matrices, and pharmaceutical dosage form matrices.

Semester 5

(1) Sterile Dosage Form Technology (FAF 311)

This course consists of sterilization technique of sterile dosage forms, basic concept of sterilization test and process, design of sterile dosage form, principles of sterile formulation, pre-formulation, excipients, equipment systems on dosage form preparation, formulation, preparation, evaluation and validation of sterile dosage form.

(2) Physicochemical Analysis (FAF 312)

This course give understanding on several spectroscopic techniques in physicochemical analysis of drug compounds in pharmaceutical dosage form. Definition, terminology, basic concepts, operational principle, instrumentation, and the use of each spectroscopic technique for drug analysis (both qualitatively and quantitatively).

(3) Pharmacokinetics (FAF 313)

This course consists of drug biotransformation process in the body and pharmacokinetic process of drug (absorption, distribution, metabolism, and excretion).

(4) Pharmacotherapy of Gastrointestinal, Respiratory Tract, Bone and Joint Diseases and Special Conditions (FAF 314)

This course explains pathophysiology and pharmacotherapy of several diseases of digestive and respiratory tract, and pharmacotherapy in special conditions (hepatic dysfunction, renal dysfunction, pediatric and geriatric populations).

(5) Medicinal Chemistry (FAF 315)

This course explains structure and activity relationship of various drug pharmacodynamic groups and activity, stability, synthesis and analysis, outline, partial structure, conformation and constitution of drug which affect drug interaction with receptor and analysis method which can be used.

(6) English for Academic Purposes (FAF 316)

After taking the EAP, students are able to communicate in English, read textbooks and express their thoughts in English. Students are exposed to UNAND classroom culture and take part in campus activities on a regular basis throughout the EAP program

(7) Bahasa Indonesia (Academic Writing) (AND 111)

In this course, there are topics related to linguistic knowledge which supports good and correct use of Indonesian language skill. The topics are variation of language, logic of language, Enhanced Indonesian Spelling System, diction, sentences, paragraph, and academic writing.

(8) Civic education (AND 112)

This course is an orientation for students to solidify their insight and spirit of nationality, patriotism, democracy, law awareness, respect on diversity and participation in building nation based on Pancasila. This course consists of nationality, democracy, law, multicultural, and civic education for students to support the statemen who are aware of obligation and rights, smart, skilled, and

have character to be reliable in building the nation.

Semester 6

(1) Solid Dosage Form Technology (FAF 321)

This course consists of solid dosage form design, tablet formulation, operational unit in manufacturing tablets, granule and tablet evaluation, types of tablets, dissolution of solid dosage form, and modified-release dosage form.

(2) Pharmacotherapy of Cardiovascular, Endocrine, and Gynecology Disease (FAF 322)

This course explains pathophysiology and pharmacotherapy of cardiovascular disorders, renal disorders, endocrine disorders, adrenal endocrine disorders, pituitary endocrine disorders, gynecological disease, hormone pharmacotherapy as contraception.

(3) Pharmacotherapy of Hematological, Oncological, Eye Disorders, and Vaccination (FAF 323)

In general, this course consists of rational treatment in various diseases of immune system and hematopoietic system, such as autoimmune diseases, allergy, vaccinations, hematopoietic, anemia, blood coagulation disorders. Infectious diseases including viral infection, systemic fungal infection, mycosis, typhoid infection, and TB. Cancer diseases including breast cancer, cervical cancer, lung cancer, colon cancer, prostate cancer, lymphoma Hodgkin and lymphoma non-Hodgkin, acute and chronic leukemia

(4) Research Methodology and Biostatistics (FAF 324)

This course consists of theory and technique which can be applied to conduct research. This course emphasizes on experimental research, sampling techniques, data analysis, conclusion, and moral values related to anti-plagiarism.

(5) Clinical Pharmacokinetics (FAF 325)

This course consists of application of pharmacokinetic principles on patients, particularly for narrow therapeutic index drugs, including determining dose regiments, dose adjustment om patients based on special conditions (renal failure, hepatic failure, cardiac failure), dose adjustment for special populations (infants, children, geriatrics, obese, and dialysis), drug dose adjustment from intravenous to per oral administration and vice versa, clinical pharmacokinetic aspects in aminoglycosides, cardiovascular drugs (digoxin, lidocaine, procainamide, quinidine), anticonvulsants (phenytoin, carbamazepine, phenobarbital, ethosuximide), cyclosporine and theophylline.

(6) Prescription and Dispensing (FAF 326)

This course consists of prescription screening and dispensing of Cardiovascular, Hypertension, Diabetes Mellitus and Endocrine, Pediatric, Gastrointestinal, Obstetrics and Gynecology, Infectious Disease, Skin Conditions, Nervous System, and Psychiatric. This is the continuation of Compounding and Pharmacotherapy courses.

(7) Pharmacoepidemiology and Pharmacoeconomics (FAF 327)

This course explains concepts of pharmacoepidemiology and pharmacoeconomics, history and development, functions and implementation in pharmaceutical practice.

(8) Community Service Program (AND 401)

This 4-credits course provides opportunity for students to participate in an interdisciplinary community service. Students will be placed in villages/sub-districts and implement various community service programs under the supervision of appointed lecturers.

Semester 7

(1) Quality Assurance and GMP (FAF 411)

This course consists of GMP in manufacturing pharmaceutical dosage forms including 12 aspects of GMP; general aspects of GMP, production and quality control, stability and dosage form analysis program, self inspection and quality audit, documentation and qualification and quality assurance.

(2) Biopharmaceutics (FAF 412)

(3) Pharmacotherapy of Viral, Bacterial, Fungal, and Parasitic Infection (FAF 413)

In this course, student learn about definition, epidemiology, ethiology, reproductive system, life cycle and rational therapy in various cases of diseases caused by parasites, including helminthiasis, protozoan infection, and zoonosis.

(4) Clinical and Community Pharmacy (FAF 414)

This course consists of basic concepts of clinical pharmacy, history and development of clinical pharmacy, and its implementation in pharmaceutical care in pharmacy and hospital.

(5) Entrepreneurship and Leadership (FAF 415)

This course consists of topics on feasibility studies, business planning and its implementation in pharmaceutical field.

(6) Final Year Project Proposal (FAF 416)

This is an initial part of students' final project which provides opportunity for students to write their final year project proposal supervised by two research supervisors. At the end of the course, students will present their proposals in a proposal seminar, in front of a lecturers' panel.

Semester 8

(1) Final Year Project (FAF 421)

This is a continuation of final year project proposal, in which students will conduct their research, write the thesis, and present the thesis in a research result seminar. After submitting the revised thesis and completing all required courses, the student will take an oral comprehensive examination, in which the students will answer questions posed by an examiners' panel.

Electives

(1) Pollutant Analysis (PAF 4001)

This course consists of environmental pollutions types. After completing this course, students are expected to be able to identify, analyze, and monitor environmental pollutions.

(2) Drug Synthesis (PAF 4003)

This course explains drug synthesis methods, including chemical synthesis or semi-synthesis using biotechnological procedures.

(3) Biomolecules and Vaccines (PAF 4005)

This course explains basic knowledge of biomolecules (carbohydrate, protein, nucleic acid and lipid) and vaccines; classifications and mechanism of vaccines, and application of vaccines.

(4) Forensic Analysis (PAF 4007)

This course explains visum et repertum, forensic identification method, thanatology, methods of identifications, general toxicology, specific toxicology, forensic assessment and toxic identification.

(5) Bioactivity Evaluation Techniques (PAF 4009)

This course consists of concepts of bioactivity evaluation techniques, techniques in evaluating bioactivity (in vivo, in vitro, in ovo, or in situ) and how to interpret data of various bioactivity evaluations; animal surgery techniques, operating several experiment tools in bioactivity evaluation, also toxicity evaluation techniques (acute, subacute, sub-chronic, chronic, specific toxicity i.e. mutagen, teratogen, carcinogen).

(6) Preformulation (PAF 4011)

This course consists of physicochemical properties and crystallographic properties which is essential in formulation process. After completing this course, students are expected to explain basic concepts of substance investigation which are needed to formulate a pharmaceutical preparation.

(7) Public Health Pharmacy (PAF 4013)

This course explains basic concepts of public health pharmacy, history of development, its development prospect in Indonesia in the future and the implementation of pharmaceutical sciences in increasing public health degree viewed from social and community aspects.

(8) Complementary Medicine (PAF 4015)

During this course, students will learn about Complementary and Alternative Medicine (CAM) system in several countries including Indonesia. Students will get explanation on Indonesian traditional medicines (jamu, standardized herbal medicines, phytopharmaca), and regulation of traditional drug development.

(9) Radiopharmacy (PAF 4017)

This course explains introduction, atom, radioactivity, radioactive decay, radionuclide production, radioisotope generator, formulation of radiopharmaceutical preparation, labelled compound, radiopharmaceutical kits, evaluation of radiopharmaceutical dosage form and radiation protection, radiation

unit and application of radiopharmaceutical dosage form in organ systems.

(10) New Drug Delivery System (PAF 4019)

This course explains drug delivery system, classifications of NDDS, Delivery through polymer membrane, modulation activity biochemically, controlled reverse effect, delivery of drug to specific target, delivery of drug through oral route and NDDS in transdermal route, aerosol as drug delivery system, delivery of drug to lung (MDIs and DPIs), drug delivery system to nasal and colon.

(11) Basic Therapeutic Communication (PAF 4021)

This course explains definition of psychology in pharmaceutical care, communication (definition, purpose and advantage of communication), communication ethics, counselling, drug information service and drug information system.

(12) Natural Medicinal Biotechnology (PAF 4023)

(13) Teratology (PAF 4002)

This course explains in vivo test to assess teratogenicity of chemical compounds to determine its teratogenicity in human.

(14) Data Analysis System (PAF 4004)

This course consists of basics of data analysis using SPSS software. SPSS helps in selecting methods, design, and data analysis e.g. parametric and non-parametric statistics.

(15) Pharmaceutical Polymers (PAF 4006)

This course contains subjects on the basic concepts of pharmaceutical polymers: definitions, classifications, and characteristics and applications of pharmaceutical polymers in conventional dosage forms and controlled drug delivery.

(16) Molecular and Biomolecular Analysis (PAF 4008)

(17) Cosmetology (PAF 4010)

This course explains classification of cosmetics, purpose and effects of cosmetics, evaluation of cosmetics, cosmetics preparations based on their purposes, traditional cosmetics, safety of cosmetics, and legislation of cosmetics.

(18) Fermentation and Stem Cell Technology (PAF 4012)

This course explains development of biotechnology science and its application in pharmacy, including: definition and development of biotechnology, gene heredity and DNA, gene cloning, basic principles of metabolite biosynthesis by microorganism, biosynthesis of antibiotics, biosynthesis of biopolymers, extracellular enzyme production, application of PCR for bacterial identification, production of vaccines, monoclonal antibody, gene mutation, Ames method, mutagenicity test and bacterial resistance test.

(19) Marine Natural Product Chemistry (PAF 4014)

This course explains basic concepts of Marine Natural Product Chemistry which includes biosynthesis of secondary metabolite compounds from marine, as well as classification of natural compounds which have interesting bioactivity and have potential as drug sources and nutraceuticals.

(20) Molecular Pharmacology (PAF 4016)

The scope of molecular pharmacology is gene regulation and protein expression in physiologic and pathologic conditions, drug mechanism of action in cellular and molecular level. Drug action target including ion channel, transporter protein, and receptors.

(21) Veterinary Pharmacy (PAF 4018)

In general, veterinary pharmacy consist of introduction, relationship between pharmacy in veterinary, pharmacokinetics pattern in animals body, drug pharmacokinetics in health and sick animals, characteristics of drug dosage form related to pharmacokinetic and pharmacodynamic properties and animal pathophysiology, inter- and intraspecies variability, BABE, drug incompatibility and interaction, drug dosage form, formulation and evaluation of liquid, semisolid, and solid dosage form, veterinary drug dosage form development, registration and controlling of veterinary dosage form.

(22) Specialist and Medical Devices (PAF 4020)

This course explains introduction and rational use of over the counter medicines, and pharmacy compulsory drugs, as well as introduction and use of medical devices (reusable or disposable).

(23) Nutraceuticals (PAF 4022)

This course provides knowledge on Nutraceuticals.

(24) Hospital Pharmacy (PAF 4024)

This course consists of Hospital Pharmacy concepts, history and development, functions and implementation in pharmaceutical practice according to Standards of Pharmaceutical Service in Indonesia (Health Minister Ordinance 1197/2004).