COURSE MODULES

LEVEL 1.1

Anatomy & Physiology
This module introduces the anatomy and functions of the human body. It equips students with an understanding of the anatomy and physiology of the cardiovascular, respiratory, renal, gastrointestinal, neuromuscular, skeletal, endocrine and reproductive systems.

Career & Professional Preparation I
This module is part of the Education and Career Guidance framework to provide students with the tools and resources necessary for their career and/ or further education. In this first module, students will undergo personal discovery and exploration of industry and career prospects. Students will learn how to and set achievable goals in preparation for their future. Students will also learn the importance of passion and professionalism, and basic teamwork and interpersonal skills.

Cell & Molecular Biology
This module explores mammalian cells, tissue and organ systems, and prokaryotic and eukaryotic genetics at the molecular level. Topics include the fundamental chemicals of life, structure and the function of cells and organelles, cell division, cytogenetics, DNA structure, replication, transcription, and translation, protein synthesis, gene mutation, cell communication, mitosis and meiosis, genetics and hereditary, apoptosis and cancer.

Organic & Biological Chemistry
In this module, students are introduced to the chemistry of hydrocarbons, alcohols, amines, aldehydes, ketones, carboxylic acids and their derivatives. The structures, functions and chemical reactions of biological molecules, including carbohydrates, lipids and proteins and their derivatives are also covered.

LEVEL 1.2

Biostatistics
This module is designed to provide students with basic statistical skills to analyse and interpret simple biological, pre-clinical and clinical data. The basic statistical skills covered are descriptive statistics, data distribution, set sample size, measurement of central tendency, scatter diagram, cluster analysis and simple linear correlation and regression analysis for linear data. The presentation of data in graphical forms using Microsoft Excel covers selection and preparation of different types of graphs, how to write titles and legends and interpretation of results.

Inorganic & Physical Chemistry
The module covers the structure of matter, chemical bonding, thermochemistry, chemical equilibria, kinetics, electrochemistry and redox reactions, transition metal chemistry, and chemistry of solutions, including acids, bases and buffers, polarity and solubility.

Introduction to Pharmacy
This module introduces students to pharmaceuticals and the roles, responsibilities, job scope and future of pharmacists and pharmacy technicians. It provides a foundation for subsequent modules in the course. Introductory topics in pharmacology, pharmaceutical science and pharmaceutics will be covered, and students will learn to perform pharmaceutical calculations to determine dosages.

Mathematics
This module provides students with a fundamental analytical knowledge of mathematics essential for the study of pharmaceutical and life science. The rules of conversion of one unit of measurement to another as well as basic mathematical operations will be covered. Students will also learn the properties governing the operation of polynomial, exponential and logarithmic functions and understand their applications in chemistry and biology.

COURSE CURRICULUM

Module Name	Credit Units
YEAR 1	
Level 1.1 (27.5 hours per week)	
Anatomy & Physiology	6
Career & Professional Preparation I	1.5
Cell & Molecular Biology	7
Organic & Biological Chemistry	7
Innovation Toolkit ^	4
Sports & Wellness ^	2
Level 1.2 (24 hours per week)	
Biostatistics	3
Inorganic & Physical Chemistry	7
Introduction to Pharmacy	7
Mathematics	3
Critical Thinking & Communication ^	4

Notes:
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IS Modules
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COURSE MODULES

LEVEL 2.1

Current Good Manufacturing Practice
This module aims to equip students with an understanding of current Good Manufacturing Practice regulations for pharmaceuticals and related products. Various aspects, such as attributes of materials, labelling, materials in process, finished pharmaceuticals, manufacturing validation, quality control, personnel and facilities are covered.

Pharmaceutical Analysis
This module studies modern analytical techniques that are used for the detection, identification and quantitative determination of drugs and related substances.
Techniques for the evaluation of analytical data and validation of analytical methods will be discussed.

Pharmaceutics
This module focuses on the design and formulation of two-phase pharmaceutical products, including suspensions, emulsions and solid pharmaceutical products, and how they relate to absorption and drug delivery routes. Topics include drug formulations, preparation and dispensing of pharmaceuticals, introduction to biopharmaceutics, pharmacokinetics, bioavailability, specialised dosage forms, prodrugs, liposomes, targeted drug delivery, drug stability of various formulations and shelf life.

Pharmacology
This module covers the basic principles of pharmacology, the mechanism of drug action, dose response relation, adverse reaction, pharmacokinetics (absorption, distribution, metabolism, elimination) and major drug classes.

Pathology
This module helps students to understand the causes and mechanisms of disease. Students will learn about disease processes affecting common organ systems. The mechanisms of disease, natural history and progression and implications for treatment and prevention will be discussed.

LEVEL 2.2

Applied Biostatistics
This module covers advanced statistical skills to analyse and interpret a wide range of biological, pre-clinical and clinical data, and preparation of data for scientific presentation. The statistical skills covered are biological experiment design, hypothesis testing, quantitative data analysis by parametric and non-parametric methods, qualitative data analysis by Chi-square and Fisher tests, and simple correlation and regression analysis for non-linear data. The scientific presentation section covers how to organise data, prepare and incorporate statistical results on graphs and interpretation of results.

Career & Professional Preparation II
This module is part of the Education and Career Guidance framework to provide students with the tools and resources necessary for their further career and/or education. In this module, students will explore basic job search strategies, practise writing effective resumes and cover letters, and learn interview skills. Students will also learn professional and intercultural communication skills to prepare them for a dynamic and diverse workplace.

Clinical Biochemistry
This module expands on the basic biochemical concepts taught in earlier modules and allows students to better understand the biochemical processes in the human body systems. The application of core biochemistry knowledge to the diagnosis and treatment of diseases in clinical practice is covered.

Clinical Immunology
This module introduces students to the fundamentals of immunology. The module will provide an understanding of how the immune system functions. Topics include an overview of the immune system, innate and adaptive immunity, humoral and cell-mediated immunity, immunisation, vaccination, laboratory immunological techniques, diseases of the immune system and antibody-based therapies.

Medicinal Chemistry & Drug Discovery
The first part of this module highlights the drug discovery process and how compounds are identified and developed into drugs. The second part of the module introduces students to the chemistry of drugs and drug systems, with particular emphasis on heterocyclic chemistry and the major drug classes. They will also learn about the relationship between activity and functional group chemistry, and drug design.

Microbiology & Infectious Diseases
This module studies medical microbiology, microbial pathogenesis and antimicrobial therapy. The module covers fundamental information regarding microorganisms, specifically pathogenic bacteria, fungi and viruses. Topics include mechanism of disease production, antibiotic resistance, emerging pathogens, contamination, sterilisation and disinfection, infection control, methods of treatment and prevention of disease.

COURSE CURRICULUM

Module Name	Credit Units

YEAR 2	
Level 2.1 (25 hours per week)	
Current Good Manufacturing Practice	2
Pathology	4
Pharmaceutics	6
Pharmaceutical Analysis	6
Pharmacology	5
Interdisciplinary Studies (IS) elective ^	2
Level 2.2 (26 hours per week)	
Applied Biostatistics	3
Career & Professional Preparation II	2
Clinical Biochemistry	4
Clinical Immunology	4
Medicinal Chemistry & Drug Discovery	5
Microbiology & Infectious Diseases	6
Interdisciplinary Studies (IS) elective ^	2

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COURSE MODULES

LEVEL 3.1

Clinical Pharmacy
This module introduces the rational selection and the use and effects of drugs on individual patients and patient groups. Students will learn the application of quantitative clinical data in the optimisation of drug therapy, as well as pertinent clinical therapeutic material that enables them to optimise patient therapies in a wide range of disorders.

Good Dispensing Skills
This module equips students with a better understanding of good dispensing practice and patient counselling skills. Students will develop good communication skills and techniques required to respond effectively to the needs of patients in
a pharmacy. They will learn about guidelines for prescription handling and practise dispensing common prescriptions.

Pharmacotherapeutics
This module highlights the use of drugs in the treatment of diseases as well as the biochemical and physiologic effects of drugs and their mechanisms of action.
Students will learn how drugs are evaluated, the mechanism of how drugs act, and their side effects.

Project A

In Project A, students will undertake a clinical, operational or laboratory research project relevant to pharmacy practice in groups of two or three under the supervision of NUH staff. Students will commence Project A by attending a series of lectures covering aspects such as writing a literature review, project management and statistical analysis of data.

LEVEL 3.2

Aseptic Dispensing & Compounding

This module provides students with the basic skills used in the pharmacy compounding laboratory.
This includes an understanding of the techniques, calculations, facilities and quality control and assurance in aseptic dispensing. Students will learn to prepare total parenteral and enteral nutrition, IV admixtures and cytotoxic drug preparation, and will be given hands-on experience in compounding different types of extemporaneous preparations.

Pharmacy Management & Logistics

This module focuses on business aspects of the operation of hospital and retail pharmacies. Topics include procurement, logistics and inventory management, business automation, marketing and principles of finance pertaining to the operations of a pharmacy.

Pharmacy Practice

This module equips students with effective communication skills for interacting with patients, caregivers and other health professionals. Topics include how to respond to patients, crisis intervention, dealing with people from culturally diverse backgrounds, dealing with grief and loss, and patient education. Good pharmacy practice relating to the dispensing and reformulation of commercial pharmaceutical products will also be discussed, as well as the Code of Ethics, and the impact of legal and ethical issues on drug management.

Project B

In Project B, students will continue to work on their research project. Upon completion of their project, students will submit a written scientific report and present their findings by giving an oral PowerPoint presentation and a scientific poster presentation.

ELECTIVES

Choose any 1

Biopharmaceutical Analysis

This module is designed to equip students with knowledge and molecular techniques that are used to analyse raw materials and biological products. Topics include an overview on biologics production using microbial and mammalian systems, detection of adventitious agents in biological products using quantitative PCR (qPCR), endotoxin and pyrogen testing, bioburden test, and detection of residual host cell proteins using enzyme linked immunosorbent assay (HCP-ELISA). An overview on pharmaceutical law and regulatory landscape will also be covered.

Complementary Medicine & Traditional Chinese Medicine (TCM)

This module describes how philosophies of alternative medicines and therapies are used to complement those of conventional medicine. The mechanism of action, dosage forms and pharmacological aspects of selected complementary medicines and traditional Chinese medicines will be covered, including the responsibilities associated with the sale and marketing of complementary medicines.

Nutrition & Dietetic Science

This module provides students with a basic understanding of nutritional and dietetic concepts, including the role of micro and macronutrients in the diet and their effects on health. Principles of clinical nutrition and dietary requirements for special medical conditions and at different life stages will also be covered. Students will also learn to evaluate the evidence behind the use of common nutraceuticals and functional foods for health benefits as well as the regulations associated with the sales and marketing of such therapies.

Translational Medicine

This module emphasises the molecular and cellular basis of disease processes and helps students understand the importance of molecular targets for disease prevention and therapy. Students will gain new understanding of disease, clinical and molecular diagnostic tools.

COURSE CURRICULUM

Module Name	Credit Units
YEAR 3	
Level 3.1 (32 hours per week)	
Clinical Pharmacy	8
Good Dispensing Skills	4
Pharmacotherapeutics	9
Project A	7
Interdisciplinary Studies (IS) elective ^	2
World Issues: A Singapore Perspective ^	2
Level 3.2 (32 hours per week)	
Aseptic Dispensing & Compounding	5
Pharmacy Management & Logistics	8
Pharmacy Practice	8
Project B	7
Electives:	
Biopharmaceutical Analysis	4
Complementary Medicine & Traditional Chinese Medicine (TCM)	4
Nutrition & Dietetic Science	4
Translational Medicine	4

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