Outcome-based education (OBE) Curriculum
of
Master of Pharmacy (M. Pharm)

Academic Session: 2023-2024

Department of Pharmacy
Faculty of Science
Comilla University
Cumilla-3506, Bangladesh

Department of Pharmacy

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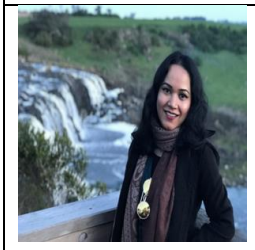	**Mantasha Tabassum** (on Study Leave) Assistant Professor **Email:** mantu.shonkho@gmail.com **Research Interest:**

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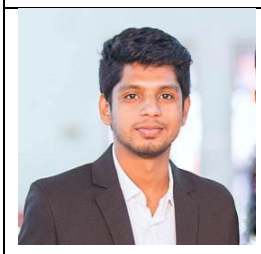	**Joy Chandra Rajbangshi** Assistant Professor **Email:** joyraj@cou.ac.bd **Research interest:** Method Development & Validation Formulation & Drug Delivery System
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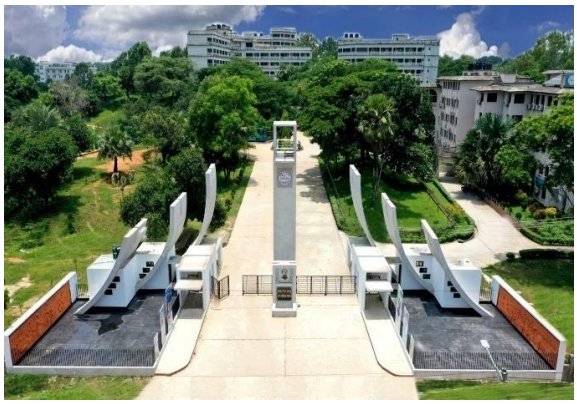
Outcome-based education (OBE) Curriculum

Part A: Introduction

Comilla University at a Glance



Comilla University is a public university located in Kotbari, Comilla, Bangladesh. It was established in 2006, and it is the 26th public university in Bangladesh. The university was founded with the goal of providing higher education opportunities to students all over the Bangladesh. The university has a beautiful and spacious campus covering an area of 250 acres. It is situated in a serene environment, surrounded by lush green trees, and is an ideal place for learning. The campus is equipped with all the necessary facilities and infrastructure required for students to excel in their academic pursuits.

Comilla University offers undergraduate and graduate programs in various fields, including Arts, Science, Business Administration, Social Science, Engineering and Law. The university has a distinguished faculty, many of whom have earned their Ph.D. degrees from renowned universities around the world. The faculty members are committed to providing quality education to their students and have a strong focus on research. The university has a modern library with a vast collection of books, journals, and research papers.The library is a valuable resource for students and researchers who can access the latest information in their respective fields. The university also has well-equipped laboratories and computer facilities that cater to the needs of students and researchers. Apart from academic programs, Comilla University offers various extracurricular activities for students to engage in. The university has several clubs and organizations, including cultural, sports, and debate clubs. These clubs help students develop their leadership skills, socialize with their peers, and explore their talents outside the classroom. Comilla University has a vibrant and diverse student community, with students from different regions of Bangladesh and other countries. The university provides a welcoming and inclusive environment for all students, regardless of their background or beliefs.

Vision of the University

Comilla University is committed to produce graduates who are distinctively capable to advance growth and welfare through innovative solutions.

Mission of the University

To meet its vision, Comilla University sets its missions to –

1. To educate a wide variety of students through effective teaching-learning to achieve academic excellence.
2. To create an ambience for creative and innovative academic exercise through high quality research.
3. To undertake actions regarding collaboration which entails opportunities for long-term interaction with academia and industry for producing competent graduate at workplace
4. To develop human potential to its fullest extent so that intellectually capable and socially responsible leaders can emerge in a range of profession. (Draft Final)

Graduate Attributes:

Comilla University is committed to lead through providing effective teaching, research and culturally enriched educational experience that will transform the lives of its students. Aspiration of the university is to produce graduate through developing knowledge, skill and attitudes to equip them to promote growth and welfare of the rapidly changing world.
In addition, to their subject specific expertise (Mastery of Subject Knowledge) the university graduates will have the following attributes:

- Critical thinking, creativity and innovation
- Communication-Language Proficiency and &Digital Literacy
- Professionalism and Ethical
- Entrepreneurial and Leadership
- Community Engagement and Social responsibility-Cross cultural Communication
- Lifelong learning

Description of the Department of Pharmacy

The Department of Pharmacy was established in 2013. A five (05) years Program (Bachelor in Pharmacy, B. Pharm) and one (01) year Master's Program (M. Pharm) are running in the department. A four (04) years B. Pharm program (OBE Curriculum) has been running from the academic session 2022-2023. Since the past pharmacists have played a significant role in public health by discovering and developing numerous therapeutic and life-saving drugs. In the present era, the demand for pharmaceutical products has expanded sharply to manage numerous diseases. Pharmacists are the experts in drugs or medicines. To meet the demand for efficient pharmacists and to improve the health care system, the department of pharmacy, Comilla University is trying to do its best in education and research.

Our course curriculum is designed in such a way that after graduation students will be able to provide best services to society through quality drug manufacturing and by providing patient care through the safe and effective use of medicines either in hospital or community pharmacy as well as in emergent drug innovation research. An optimum balance between theory and practical knowledge is maintained in the overall structure of the curriculum. Currently, the department has 13 efficient and qualified faculty members who supervising students along with the academic activities. We have laboratory facilities for advanced research in Natural Product Chemistry, Pharmacology, Pharmaceutical Microbiology, and Pharmaceutical Technology. Also, the development of more laboratories is progressing.

After graduation from the Department of Pharmacy, a graduate can contribute to any challenging research collaboration by participating with the research groups at home and the world-wide renowned institutes or universities. Alumni of this department are currently working in several pharmaceutical industries in Bangladesh. The faculty members, staffs, and students of the department are working hard collaborate to bring this achievement successfully. The Department of Pharmacy, Comilla University is playing a significant role in creating a way of success that will make skillful human resources for the enrichment of the health care system and sustainable development of the country.

Vision of the Department of Pharmacy:

The vision of the program is to lead the way towards effective global health care through innovative pharmacy education, research and practice.

Mission of the Department of Pharmacy:

The Department of Pharmacy missions is to improve standard of lives locally and globally by educating students who will conduct contemporary research, promote quality of drugs, innovate modern techniques for production of standard drugs and to lead professional service for human being.

Description of the Master of Pharmacy (M. Pharm)

The duration of the Master Degree Program in Pharmacy may vary based on the modes of study. There are three modes which are the following:

(a) Master by Coursework,
(b) Master by Mixed-mode

A Master's by Coursework entails taught courses to a minimum of 40 credits while a Mixed-mode Master's has a minimum of 18 credits in taught component and a research component involving a thesis/dissertation. A student's assessment is based on his/her performance in both components.

Table 1.1: Program Type and Duration

Program Type	Program Duration		
	Number of Semester	Duration in Year	
	Semester (Min.)	Year (Min.)	Year (Max.)
Master's by Coursework	02	1.0	2.0
Master's by Mixed-mode	03	1.5	3:0

Vision of Master of Pharmacy (M. Pharm)

The vision of the Pharmacy is to become a globally functioning academic institution that advances the science of pharmaceuticals via consulting, education, expertise in research, and operational competence.

Master of Pharmacy (M. Pharm)

M1:	The essence of Department of Pharmacy is to constantly strive to provide an in-depth knowledge to its students so that they add value to the existing treasures of drug formulation and evaluation, pharmacy practice, drug discovery, drug design and development concepts.
M2:	Promote lateral thinking and a spirit of enquiry among our students so that

	they look from a different angle through a creative approach by which they are able to serve the community with their leadership for sustainable growth to meet the 21st century need.
M3:	To foster opportunities for the students to establish a close connection with alumni, international academics and employers to collaborate, address current need, and maintain an interactive relation with the professionals

Program Educational Objectives (PEO'S)

PEOs	Description	Domain
PEO1:	To provide graduates with theoretical and practical knowledge to cater in various areas including pharmaceutical industry, hospital pharmacy, community pharmacy, regulatory affairs, academia and research.	Fundamental
PEO2:	To produce skilled graduates by providing them appropriate training in all aspects required to meet the need of pharmacy profession.	Fundamental
PEO3:	To equip students with interdisciplinary knowledge for developing competence in solving complex problems in the field of pharmaceutical science.	Thinking
PEO4:	To offer an academic atmosphere that enables the graduates to acquire behavioral, moral and ethical attitudes required for sound professional practice.	Social
PEO5:	To encourage graduates in life-long self-learning process for developing the ability to serve the society with greater benefits.	Personal

Mapping of PEOs and Mission of Master of Pharmacy (M. Pharm)

PEOs / **Missions**	PEO1	PEO2	PEO3	PEO~~5~~4	PEO5
M1	3	3	2	2	2
M2	2	3	3	3	3
M3	3	2	1	2 3	2
Correlation: 1-Low; 2- Significance; 3-High					

Program Learning Outcomes (PLO'S)

At the end of the program, students will be able to

PLO1	**Fundamental Knowledge:** Assimilate theoretical along with practical knowledge of pharmaceutical sciences.
PLO2	**Technical Expertise:** Apply technical knowledge in manufacturing and quality control of drug products.
PLO3	**Interpersonal communication Skills:** Communicate with patients, health care professionals and other stakeholders to deliver their acquired knowledge effectively.
PLO4	**Leadership Skills and team work:** Acquire expertise in leadership through curricular and co-curricular activities to lead and contribute for the achievement of organizational goals.
PLO5	**Research and innovations:** Perform research in different field of pharmacy and keep connected with contemporary research.
PLO6	**Patient Care:** Develop a foundational set of skills and abilities to provide consistent and comprehensive patient care.
PLO7	**Lifelong Learning Skills:** Exploit soft skills complementing hard skills to cope up with the changing world.
PLO8	**Entrepreneurship**: Apply skills for designing, launching and running a new ideas and initiatives to promote better health care for the community.
PLO9	**Professionalism and ethics:** Practice pharmacists' professionalism and ethics.
PLO10	**Society and pharmacists:** Develop sense of responsibilities of pharmacist to the society and nation.

Mapping between PEOs and PLOs of Pharmacy program

PLOs / PEOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
PEO1	3	3	2	1	2	2	1	2	1	1
PEO2	2	3	2	2	2	3	1	2	2	2
PEO3	2	3	2	2	3	2	2	2	2	2
PEO4	1	1	3	3	2	2	1	1	3	3
PEO5	1	2	3	2	3	2	3	3	2	3

(Level of correlation: 3-High, 2-Medium, 1-Low)

Graduates Profile

Scholars: Our graduates are expected to have a broad knowledge-base and disciplinary expertise.

Problem Solvers: With an adequate knowledge of disciplinary expertise and problem domain our graduates will be in a position to formalize any problem and solve that in a methodical way.

Innovators: We want our graduates to be focused on future-proof solution. They will be critical thinkers, creative designers and efficient makers. They are capable of developing unique and sustainable solutions to the real-world problems.

Leaders: Graduates of our department will take personal responsibility and seek opportunities to work with others to advance thinking and achievement in all spheres of their lives. They are confident, inclusive, inspiring and influential.

Global Citizens: Our graduates are locally produced but globally in demand. They are aware of global issues and act with integrity, sensitivity and fluency across cultures and perspectives, and are committed to the betterment of the society as a whole.

Part B – Structure

Structure of the Curriculum

Master by Mixed mode							
Semester	**BNQF Code**	**Course Code**	**Course Title**	**Credit Hrs**	**Marks**		
					CIE	**SEE**	**Total**
First Semester	0916-6101	PHARM 6101	Advanced Pharmaceutical Analysis	3	40	60	100
	0916-6102	PHARM 6102	Advanced Medicinal Chemistry	3	40	60	100
	0916-6103	PHARM 6103	Advanced Pharmaceutical Technology	3	40	60	100
	0916-6104	PHARM 6104	Advanced Pharmacology & Toxicology	3	40	60	100
	0922-6105	PHARM 6105	Public Health & Epidemiology	2	20	30	50
	0916-6106	PHARM 6106	Research Methodology	2	20	30	50
			Total	**16**			**500**
Second Semester	0916-6201	PHARM 6201	Advanced Clinical Pharmacy	3	40	60	100
	0916-6202	PHARM 6202	Advanced Molecular Biology	3	40	60	100
	0613-6203	PHARM 6203	Data Science and Programming	3	40	60	100
	0916-6204	PHARM 6204	Advanced Biopharmaceutics	3	40	60	100
	0916-6208	PHARM 6208	Thesis Synopsis & Pre-Defence	2			50
			Total	**14**			**450**
Third Semester	0916-6301	PHARM 6301	Dissertation	12			100
			Total	**12**			**100**
			Grand Total	**42**			**1050**

Master by Coursework							
Semester	**BNQF Code**	**Course Code**	**Course Title**	**Credit Hrs**	**Marks**		
					CIE	**SEE**	**Total**
First Semester	0916-6101	PHARM 6101	Advanced Pharmaceutical Analysis	3	40	60	100
	0916-6102	PHARM 6102	Advanced Medicinal Chemistry	3	40	60	100
	0916-6103	PHARM 6103	Advanced Pharmaceutical Technology	3	40	60	100
	0916-6104	PHARM 6104	Advanced Pharmacology & Toxicology	3	40	60	100
	0922-6105	PHARM 6105	Public Health & Epidemiology	2	20	30	50
	0916-6107	PHARM 6107	Pharmaceutical Analysis & Quality Control Lab	2	20	30	50
	0916-6108	PHARM 6108	Advanced Pharmacology and Toxicology Lab	2	20	30	50
	0916-6109	PHARM 6109	Advanced Pharmaceutical Technology Lab	2	20	30	50
			Total	**20**			**700**
Second Semester	0916-6201	PHARM 6201	Advanced Clinical Pharmacy	3	40	60	100
	0916-6202	PHARM 6202	Advanced Molecular Biology	3	40	60	100
	0613-6203	PHARM 6203	Data Science and Programming	3	40	60	100
	0916-6204	PHARM 6204	Advanced Biopharmaceutics	3	40	60	100
	0916-6205	PHARM 6205	Industrial Management & Regulatory Affairs	2	20	30	50
	0916-6206	PHARM 6206	Pharmaceutical Documentation - Lab	2	20	30	50
	0916-6207	PHARM 6207	Advanced Biopharmaceutics - Lab	2	20	30	50
	0916-6209	PHARM 6209	Viva Voce	2			50
			Total	**20**			**600**
			Grand Total	**40**			**1300**

Mapping Courses with PLOs

Thesis Group										
BNQF Code	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
0916-6101	3	3	2	2	2		2	2	1	
0916-6102	3	2		2	3		2	3		1
0916-6103	3	3	2		2		2	2	2	
0916-6104	3	3	2		2	2		2	2	2
0922-6105	2		3	3	3	3		3		2
0916-6106	2	3	2	3	3		3	3	2	1
0916-6201	3	3	3		1	2		2	2	2
0916-6202	3	3			3		2	2		
0613-6203	3			2	2		2			
0916-6204	3				2	1			2	1
0916-6208			2	3	3		2	1		
0916-6301			3	3	3		2	2		2
Non-Thesis Group										
0916-6101	3	3	2	2	2		2	2	1	
0916-6102	3	2		2	3		2	3		1
0916-6103	3	3	2		2		2	2	2	
0916-6104	3	3	2		2	2		2	2	2
0922-6105	2		3	3	3	3		3		2
0916-6107	3	3			2		2		2	
0916-6108	3	3			2		2			
0916-6109	3	3			2		2			
0916-6201	3	3	2	2	2		2	2	1	
0916-6202	3	2		2	3		2	3		1
0613-6203	3	3	2		2		2	2	2	
0916-6204	3	3	2		2	2		2	2	2
0916-6205	3	2	2	3			1		2	1
0916-6206	3	2	2	2			1		1	
0916-6207	3	3			1	2			1	1
0916-6209	2	2	3		2		1		2	

PART C

Detailed Curriculum

Course Code: 0916-6101 (PHARM 6101)	Year: First	Semester: First
Course Title: Advanced Pharmaceutical Analysis		
Course Status: Core		
Credit: 3.0	Total Marks: 100	
Prerequisite(s): None		
Rationale	To understand and interpret of different advanced analytical techniques (such as NMR, MS, PCR, electrophoresis, blotting techniques and DNA microarray) in details is crucial for the qualitative/quantitative analysis of pharmaceuticals, structural elucidation of new bioactive molecules, drug discovery, interpretation of drug-drug interaction, proteomics and peptide analysis, detection of free radicals in biological system and identification of diseases.	

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Develop student's knowledge in details about principle and instrumentation, interpretation and analysis of NMR and Mass spectroscopic data that are critical to pharmaceutical analysis as well as identification of new molecules, drug design and development.
CLO2	Demonstrate an understanding of theory and practical applications of the ESR data for the detection of free radical reactions in chemical and biological systems.
CLO3	Uplift student's knowledge in details about principle and instrumentation of SDS-PAGE, various electrophoretic techniques which are critical to pharmaceutical analysis as well as molecular biological analysis.
CLO4	Demonstrate an understanding of theory and practical applications of the ELISA, blotting techniques for the detection of biochemical reactions and detection of biomolecules.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	3		3	3		3	2		
CLO2	3	3		3	3		3	2		
CLO3	3	3		3	3		3	2		
CLO4	3	3		2	3		3	2		

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	Course Contents	Hrs	CLOs
01	Nuclear Magnetic Resonance (NMR) Spectroscopy : Advanced Techniques and Applications NMR: 1H and 13C NMR, principles, instrumentation, principles of decoupling, gated decoupling, difference spectroscopy, relaxation process, population transfer, selective polarization transfer, INEPT, basic two dimensional sequence, heteronuclear shift correlation, application of DEPT, 1H-1H 14, COSY, HMBC, HMQC, HOHAHA (TOCSY), NOE's in structure elucidation of organic compounds. NMR in drug screening, reaction monitoring etc. Applications of NMR in medical sciences.	12	CLO1
02	Electron Spin Resonance (ESR) Spectroscopy: Introduction, principles, instrumentation and application in detection of free radical reactions in chemical and biological systems.	6	CLO2
03	Mass spectroscopy (MS): Theory, instrumentation and ionization methods (FAB, ESI, MALDI, FD, etc.). Application of HRIEMS, MS-MS, GC-MS, LC-MS. Mass spectrometers (MALDI TOF, ES) in structure elucidation of small and macromolecules	6	CLO1
04	Electrophoresis: Agarose gel electrophoresis, pulse field gel electrophoresis, polyacrylamide gel electrophoresis (PAGE), SDS-PAGE, 2D gel electrophoresis, isoelectric focusing, isotachophoresis, capillary	10	CLO3

	electrophoresis.		
05	ELISA (Enzyme Linked Immuno-Sorbent Assay): Principles, classification, methodology, detail of sandwich ELISA, application.	8	CLO4

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning& Assessment Strategy:

CLOs	Topic	Teaching-Learning Strategies	Assessment Strategies
CLO1	Nuclear Magnetic Resonance (NMR) Spectroscopy & Mass spectroscopy (MS)	White board, Lecture, PPT Demonstration, Group discussion for problem analysis	Class test (Short Q and MCQ), Assignment
CLO2	Electron Spin Resonance (ESR) Spectroscopy	White board, Lecture, PPT Demonstration, Group discussion for problem analysis	Class test (Short Q and MCQ), Presentation
CLO3	Electrophoresis	White board, Lecture, PPT Demonstration	Class test (Short Q and MCQ)
CLO4	ELISA (Enzyme Linked Immuno-Sorbent Assay)	White board, Lecture, PPT Demonstration, Group discussion for problem analysis	Class test (Short Q and MCQ)

References books:

Watson, D.G. (2020). Pharmaceutical Analysis: A Textbook for Pharmacy Students and Pharmaceutical Chemists. (5th ed.). Elsevier.

Sharma, Y. R. (2005). Elementary Organic Spectroscopy. New Delhi: S. Chang and Company Ltd.

Field, L.D., Sternhell, S. and Kalman, E.D. (2008) Organic structure from spectra. (4th ed.) England: Wiley and Sons Ltd.

Vogel. (1991). Textbook of Quantitative Chemical Analysis. (5th ed.). Singapore: Addison Wesley Longman Ltd.

Supplementary Readings:

Beckett and Stenlake. (1997). Practical Pharmaceutical Chemistry (Part I and II). 4th ed.). New Delhi: CBS Publishers and Distributors.

Merrit, W. and Settle, D. (2004). Instrumental Methods of Analysis. (7th ed.) CBS Publishers & Distributors.

B. K Sharma, B.K. (2005). Spectroscopy. Meerut, India: Goel Publishing House

Journal of Natural Products

Bioorganic and Medicinal Chemistry Journal

ASSESSMENT PATTERN:

CA- Continuous Assessment (Formative Assessment) (40%), Total Marks: 40

Bloom's Category	Mid-Semester	Assignment and/or Term paper	Class Test and/or Quiz and/or In-	External Participation

(35 out of 40)	Exam (20%) Total Marks: 20	preparation & Presentation and/or case study and/or Field work (10%). Total Marks: 10	course and/or Sudden Test (5%) Total Marks: 5	in Curricular/Co-Curricular Activities (0)
Remember	6		2	
Understand	4	2	4	
Apply	4	2	4	
Analyze	4			
Evaluate	2			
Create		1		

*Class Attendance: 05

SFE-Semester Final Examination (Summative Assessment 60%), Total Marks: 60

Bloom's Category	Marks
Remember	15
Understand	10
Apply	15
Analyze	10
Evaluate	5
Create	5

Course Code: 0916-6102 (PHARM6102)		Year: First	Semester: First
Course Title: Advanced Medicinal Chemistry			
Course Status: Core			
Credit: 3.0		Total Marks: 100	
Prerequisite(s): None			
Rationale	The course in Advanced Medicinal Chemistry will provide in-depth knowledge and the fundamental principles of the design, development, synthesis and biological evaluation of new medicines as potential lead compounds. This course will provide a mechanistic understanding of the drug resistance, and their relevance to the molecular level. The course will with an overview of biochemical macromolecules and their biosynthetic pathways and reactions. The course provides a brief overview on oxidative stress mediated cellular damages and role of antioxidants in the management of human diseases. Metabolite antagonist in this course introduce key molecular concepts to the students that interferes with the utilization of a substance essential in metabolism and their association in biomolecular targets.		

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Optimize the design, develop a new drug like molecules for biological targets.
CLO2	Uplift student's knowledge about computer assisted drug design and their application.
CLO3	Grasp the drug resistance, analyze the structural activity relationship, and predict response to chemotherapy for the best treatment of individual patients
CLO4	Identify fundamental aspects and a relationship between aging, free radical and antioxidant that influence to ensure quality life management and better understanding on cell division and antimetabolites.
CLO5	Gather knowledge about the various biosynthesis pathways of natural products and metabolite antagonism function with their use.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	3			2			3		
CLO2	2	3		1						
CLO3	3	3			3				2	
CLO4	3	3	2							
CLO4	2	3				1				

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	Course contents	Hrs	CLOs
01	Drug discovery and development: a. Drug discovery & development - the post, present, & future, Choosing disease, and choosing a drug target, identifying a bioassay, finding a lead compound, optimization of the lead compound , identification of pharmacophore and binding strategy with receptor sites, patterns and SAR of drug development from natural sources, modification synthetic analogues, drug design to improve Pharmacokinetic properties. b. Quantitative structure - activity relationships (QSAR), and its role in drug design.	8	CLO1, CLO3
02	Computer Assisted Drug Design: An overview of the role of computational chemistry in therapeutic drug design, Computational chemistry in small-molecule drug design. a. Designing drugs without a target 3D structure b. Computational aspects of small molecule design c. Application of pharmacophore-based drug design d. Structure-based drug design- use of X-ray and NMR structures e. De novo drug design based on target 3D structures f. Applications of structure-based drug design.	7	CLO1, CLO2
03	Antioxidants and Free Radicals: Antioxidants. Natural body antioxidants; Super oxide theory and Oxygen Toxicity, ROS (Reactive Oxygen Species) and LP (Lipid Peroxidation) in	5	CLO1, CLO2, CLO4

	human pathology and diseases. Antioxidant defense system; Healing power of H2O2; formation of free radicals, free radical chain reaction, free radicals and useful species, free radicals in ageing process and diseases like arteriosclerosis, ischemic heart diseases and neurodegradative conditions, toxicity of free radicals and prevention of free radical damage by antioxidants.		
04	Biosynthesis: Biosynthetic pathways and actions of steroidal hormones, alkaloids, carbohydrates and nucleotides.	5	CLO5
05	Molecular Mechanism of Drug Resistance: Causes for drug resistance, drug resistance with reference to cancer and infectious diseases, strategies to combat drug resistance in antibiotics therapy, genetic principles of drug resistance, novel molecular target discovery.	5	CLO3
06	Metabolite Antagonism: Historical development, sulfonamides and Fildes theory of antimetabolites, active site-directed irreversible enzyme inhibitors, mechanism-based enzyme inhibitors, antifolates, sulfonamides and sulfones, dihydrofolate reductance inhibitors, synergism of sulfonamides and dihydrofolate reductance inhibitors, amino acid antagonists, vitamin antagonists, pyrimidine and purine antimetabolites.	5	CLO5

Learning Materials	
Recommended Readings	1. G I Patrick : An Introduction to Medicinal Chemistry 2. Wilson and Gisvolt's:Textbook of Organic, Medicinal and Pharmaceutical Chemistry (10th ed., 1998
Supplementary Readings	J. Leonard et al. : Advanced Practical Organic Chemistry Bernard Miller : Advanced Organic Chemistry, 1995, Prentice Hall Jerry march : Advanced Organic Chemistry, Wiley Interscience Harper : Mechanism and theory of Organic Chemistry *Other resources will be provided by respective teachers

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning& Assessment Strategy:

CLOs	Topic	Teaching-Learning Strategies	Assessment Strategies
CLO1, CLO3	Drug discovery and development	Lecture, PPT Demonstration, Group discussion	Class test (Short Q and MCQ) assignment
CLO1, CLO2	Computer Assisted Drug Design	Lecture, Discussion, Group study for problem analysis	Class test (Short Q and MCQ)

			Presentation
CLO1, CLO2, CLO4	Antioxidants and Free Radicals	Lecture, Question-Answer session	Class test (Short Q and MCQ)
CLO5	Biosynthesis	Lecture, White board , Discussion, Question-Answer session	Class test (Short Q and MCQ)
CLO3	Molecular Mechanism of Drug Resistance	Lecture, Discussion, Question-Answer session	Class test (Short Q and MCQ)
CLO5	Metabolite Antagonism	Lecture, White board, Discussion, Group study for problem analysis	Class test (Short Q and MCQ)

ASSESSMENT PATTERN:

CA- Continuous Assessment (Formative Assessment) (40%), Total Marks: 40

Bloom's Category (35 out of 40)	Mid-Semester Exam (20%) Total Marks: 20	Assignment and/or Term paper preparation & Presentation and/or case study and/or Field work (10%). Total Marks: 10	Class Test and/or Quiz and/or In-course and/or Sudden Test (5%) Total Marks: 5	External Participation in Curricular/Co-Curricular Activities (0)
Remember	8			
Understand	4			
Apply	5			
Analyze				
Evaluate	3			
Create				

*Class Attendance, Total Marks: 5

SFE-Semester Final Examination (Summative Assessment 60%), Total Marks: 60

Bloom's Category	TEST (60)
Remember	25
Understand	15
Apply	10
Analyze	10
Evaluate	
Create	

Course Code: 0916-6103 (PHARM6103)	Year: First	Semester: First
Course Title: Advanced Pharmaceutical Technology		
Course Status: Core		
Credit: 3.0	Total Marks: 100	
Prerequisite(s): None		
Rationale	This course provides advanced knowledge and practical insights into modern pharmaceutical product development, focusing on controlled and novel drug delivery systems, pre-formulation studies, nanotechnology applications, scale-up strategies, and regulatory considerations. By integrating Quality by Design (QbD) and Design of Experiments (DoE) principles, students will develop skills to design, optimize, and translate laboratory formulations into scalable pharmaceutical products. The course is essential for preparing graduates to address challenges in innovative drug delivery, industrial product development, and regulatory submissions, bridging the gap between pharmaceutical research and industry practice.	

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO 1	Explain the principles and design strategies of controlled, transdermal, and nanoparticle-based drug delivery systems.
CLO 2	Analyze pre-formulation data (e.g., solubility, partition coefficient, polymorphism, thermal stability) to select appropriate dosage forms and excipients.
CLO 3	Apply Quality by Design (QbD) and Design of Experiments (DoE) methodologies to optimize pharmaceutical formulations.
CLO 4	Evaluate formulation development strategies, including prototype preparation, stability testing, and regulatory dossier compilation.
CLO 5	Design and propose scale-up and technology transfer processes for pilot plant operations in the pharmaceutical industry.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	2								
CLO2	3	3					7			
CLO3		3			3					
CLO4	3	3			3					
CLO4	3	3			3					
CLO5										

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	Course contents	Hrs	CLOs
1	Concepts and Design of Controlled Release Drug Delivery: Overview and fundamentals of controlled release dosage form, design and fabrication of controlled drug delivery system, classification of controlled drug delivery system (rate preprogrammed drug delivery systems, activation modulated drug delivery systems, feedback regulated drug delivery systems, site targeting drug delivery systems), kinetic modeling on drug release from controlled release delivery system, challenges in development of controlled release formulation.	7	CLO1, CLO3
2	Transdermal Drug Delivery System: Permeation through skin including mechanism, permeation enhances, In-vitro skin permeation, technologies for developing transdermal drug delivery system, mechanism of release kinetics, evaluation of transdermal drug delivery systems.	7	CLO1, CLO2
3	Nanoparticle Technology for Drug Delivery: Fundamentals of drug nanoparticles, manufacturing of nanoparticles, physical characterization of nanoparticles, injectable nanoparticles, polymeric nanoparticles for oral drug delivery, nanoparticles for ocular drug delivery, DNA nanoparticle gene delivery systems.	8	CLO1, CLO3
4	Pre-formulation Studies: Fundamental Aspects in Pharmaceutical Generic Product Development: Introduction: Goals of preformulation, pre-formulation methodology, solid state properties, polymorph, partition coefficient, techniques to estimate log P values, solubility, permeability, selection of dosage form based on BCS of drugs, dissolution, crystal form and stability, Thermal Analysis (DSC, DTA, TGA), Microscopy (TEM, SEM), X-ray diffraction (PXRD), X-ray diffraction techniques to generate & characterize amorphous & crystalline forms, drug-excipient compatibility study, RLD evaluation.	6	CLO1, CLO2, CLO3
5	Strategies in Pharmaceutical Product Development: Dosage form design: Preformulation considerations, Biopharmaceutical and formulation considerations Quality by Design: Introduction to QbD, Elements of QbD, Target Product Profile (TPP) and Quality Target Product Profile (QTPP), Critical Quality Attributes (CQAs), Critical Material Attributes (CMA), Critical Process Parameters (CPP), Initial Risk Assessment, Quality Risk Management (QRM), Product Design and Understanding, Process Design and Understanding. Design of experiments (DoE) to develop formulations, DoE for a tablet formulation and optimization its preliminary study.	10	CLO2, CLO3

6	Formulation Development and Scale-Up: Introduction to dosage form selection, product development strategy, product development life cycle management, time and responsibility of development plan, sourcing and approval of raw materials, analytical method development for API and drug product, prototype formulation development, stability studies, planning for registration batches, pivotal batch, Drug Master File /Dossier, CTD/eCTD, CDER documentation system, dossier compilation for regulatory submission, case studies on pharmaceutical product development, technology transfer in pharmaceutical industry, document Requirements for Execution of Technology Transfer.	7	CLO4, CLO5
7	Pharmaceutical Pilot Plant: Design, Operations and Scale-Up Techniques: Objectives of the pharmaceutical pilot plant studies, concepts of pilot plant for development and control, key factors to be considered during designing of pilot plant, lay out of a pharmaceutical pilot plant, pilot plant operation: organizational and operational aspects, pilot plant activities, steps in scale- up techniques, general considerations on pilot plant requirements, scale-up studies for different dosage forms.	7	CLO4, CLO5

Learning Materials	
Recommended Readings	1. G I Patrick : An Introduction to Medicinal Chemistry 2. Wilson and Gisvolt's :Textbook of Organic, Medicinal and Pharmaceutical Chemistry (10th ed., 1998
Supplementary Readings	J. Leonard et al.: Advanced Practical Organic Chemistry Bernard Miller : Advanced Organic Chemistry, 1995, Prentice Hall Jerry march : Advanced Organic Chemistry, Wiley Interscience Harper : Mechanism and theory of Organic Chemistry *Other resources will be provided by respective teachers

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning& Assessment Strategy:

CLOs	Topic	Teaching-Learning Strategies	Assessment Strategies
CLO1, CLO3	Concepts and Design of Controlled Release Drug Delivery	Lecture, PPT Demonstration, Group discussion	Class test (Short Q and MCQ), assignment
CLO1, CLO2	Transdermal Drug Delivery System	Lecture, Discussion, Group study for problem analysis	Class test (Short Q and MCQ), Presentation

CLO1, CLO3	Nanoparticle Technology for Drug Delivery	Lecture, Question-Answer session	Class test (Short Q and MCQ)
CLO1, CLO2, CLO3	Pre-formulation Studies: Fundamental Aspects in Pharmaceutical Generic Product Development	Lecture, White board , Discussion, Question-Answer session	Class test (Short Q and MCQ)
CLO2, CLO3	Strategies in Pharmaceutical Product Development	Lecture, Discussion, Question-Answer session	Class test (Short Q and MCQ)
CLO4, CLO5	Formulation Development and Scale-Up	Lecture, Discussion, Question-Answer session	Class test (Short Q and MCQ)
CLO4, CLO5	Pharmaceutical Pilot Plant: Design, Operations and Scale-Up Techniques	Lecture, Discussion, Question-Answer session	Class test (Short Q and MCQ)

ASSESSMENT PATTERN:

CA- Continuous Assessment (Formative Assessment) (40%), Total Marks: 40

Bloom's Category (35 out of 40)	Mid-Semester Exam (20%) Total Marks: 20	Assignment and/or Term paper preparation & Presentation and/or case study and/or Field work (10%). Total Marks: 10	Class Test and/or Quiz and/or In-course and/or Sudden Test (5%) Total Marks: 5	External Participation in Curricular/Co-Curricular Activities (0)
Remember	8			
Understand	4			
Apply	5			
Analyze				
Evaluate	3			
Create				

Class Attendance, Total Marks: 5

SFE-Semester Final Examination (Summative Assessment 60%), Total Marks: 60

Bloom's Category	TEST (60)
Remember	25

Understand	15
Apply	10
Analyze	10
Evaluate	
Create	

Course Code: 0916-6104 (PHARM6104)		Year: First	Semester: First
Course Title: Advanced Pharmacology and Toxicology			
Course Status: Core			
Credit: 3.0		Total Marks: 100	
Prerequisite(s): None			
Rationale	The course intends to familiarize Master's students regarding different receptors mediated signaling pathways; pathophysiological conditions of different life- threatening diseases like cancer, cardiovascular, neurodegenerative etc. and their treatment strategies.		

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Understand the molecular mechanism of different receptor-mediated therapeutic effects.
CLO2	Explain the pathophysiology and therapeutic management of different life-threatening diseases like cancer, ischemia, stroke, cancer and neurodegenerative diseases.
CLO3	Explain the basic principles of drug toxicities and allergies and its impact on different organs. Advise patients on the safe and effective use of drugs to ensure rational uses
CLO4	Identify the causative agents as well as understand the mechanisms, impacts and remedies of poisoning.
CLO5	Design and perform variable in vitro and in vivo experiments to know the toxicity profile of any drug or chemical.

Course Plan Specifying Contents:

SL NO.	Course Content	Hrs
1	a) Molecular and cellular mechanisms of: 1) Glutamate receptors, 2) GABA receptors, 3) Catecholamine receptors (- and - adrenoceptors, dopamine receptors), 4) Acetylcholine receptors (nicotinic and muscarinic receptors), 5) Opioid receptors. b) 5-Hydroxytryptamine: Introduction, Chemistry, Biosynthesis and metabolism, 5-HT receptor subtypes, Site of 5-HT action, 5-HT agonists and antagonists, Signaling pathway, Biochemical and molecular aspects, Clinical implications.	4
2	Pathophysiology of Heart Drugs for heart disease: *Ion channels, exchangers and pumps:* Transduction mechanisms as targets of drug action, voltage sensitive ion channels–structure and function, K + channels. Voltage sensitive Ca +2 channels and the pharmacology of their inhibitors. Agonists at - adrenoceptors. Pharmacology of Na + /K + ATPase and gap junctions. *Vasodilators:* Nitric oxide - Biosynthesis of nitric oxide and its control, Degradation and carriage of nitric oxide, Effects of nitric oxide, Therapeutic use of nitric oxide and nitric oxide donors, Inhibition of nitric oxide, Clinical conditions in which nitric oxide may play a part.	4
3	Pathophysiology of CNS: Diseases and treatment of Neurogenerative disorders: Introduction, Mechanisms of neuronal death, Ischemic brain damage (Strokes), Alzheimer's disease, Parkinson's disease, Huntington's disease, Prion disease.	4
4	Cancer biology and therapy: Introduction of cancer, causes and development of cancer, treatment strategy: radiotherapy, chemotherapy, surgery, biological therapy including immunology and gene therapy.	4
5	Basic concept in toxicology: Introduction to toxicology and its subdivisions, Types of adverse drug reaction, Risk assessment and toxicity testing, Nonmetallic environmental toxicants, Chelators and heavy metal intoxication.	4

6	The mechanism of toxin action: General mechanisms of toxin-induced cell damage and death, hepatotoxicity and nephrotoxicity, Mutagenesis and carcinogenecity – Biochemical mechanisms of mutagenesis, Carcinogenesis – genotoxic and epigenetic carcinogens, Teratogenesis and druginduced foetal damage, Allergic reactions to drugs.	4
7	The biotransformation of toxins, their inactivation and removal from the body: An introduction to biotransformation. The cytrochrome P-450 system – its function, mechanism of action and regulation. Glutathione and glutathione-S-transferase–its function, mechanism of action and regulation.	4
8	Reactive intermediates: Types of metabolically generated reactive intermediates and their role in drug toxicity. Epoxidation and drug toxicity, N-oxidation and drug toxicity, toxicity and sulfur xenobiotics.	6
9	Environment and health: Heavy metal poisoning. Arsenicosis in Bangladesh. Cadmium dilemma.	6
10	Toxicity Tests: Principles, factors (translocation, concentration, structure relationship), categories of toxicity tests (acute, prolonged, chronic, potentiation, teratogenic, reproduction, mutagenesis, carcinogenesis, skin and eye tests)	4

Mapping CLOs with Teaching –Learning and Assessment Strategy		
CLOs	Teaching-Learning Strategy	Assessment Strategy
1–5	Lecture and Team Teaching	Quiz, Class Test and Final Exam
1–5	Problem-basedLearning and Presentation	Assignment, Class Test and Final Exam
1–5	Lecture, Presentation and Group Discussion	Viva voce, Class Test and Final Exam

Learning Materials

Recommended Readings	Goodman and Gillman. (2017). *The Pharmacological Basis of Therapeutics*. Brunton, L.L., Hilal-Dandan, R. and Knollmann, B.C. (Eds). (13th ed.) McGraw- Hill/Medical. Tripathi, K.D. (2013). *Essentials of Medical Pharmacology.* (7th ed.). New Delhi, India: Jaypee Brothers Medical Pub. Lippincott. (2018). *Pharmacology.* Whalen, K. (Eds). (7th ed.). Lippincott Williams & Wilkins. 5. Satoskar, R.S., Rege, N. and Bhandarkar, S.D. (2015). *Pharmacology and Pharmacotherapeutics (vol. I and II).* (24th ed.) Elsevier.
Supplementary Readings	Casarett and Doull. (2018). *Toxicology: The Basic Science of Poisons.* (9th ed.) McGraw Hill. Olson, K., Anderson, I., Benowitz N. and Blanc, P. (2017). *Poisoning and Drug Overdose.* (7th ed.). McGraw Hill/Medical. Casarett & Doull. (2021). *Essentials of Toxicology.* Klaassen, C. and Watkins, J. (Eds). (4th ed.). McGraw Hill/Medical. Health journals Health Magazines, 5. Related websites

ASSESSMENT PATTERN:

CA- Continuous Assessment (Formative Assessment) (40%), Total Marks: 40

Bloom's Category (35 out of 40)	Mid-Semester Exam (20%) Total Marks: 20	Assignment and/or Term paper preparation & Presentation and/or case study and/or Field work (10%). Total Marks: 10	Class Test and/or Quiz and/or In-course and/or Sudden Test (5%) Total Marks: 5	External Participation in Curricular/Co-Curricular Activities (0)
Remember	8			
Understand	4			
Apply	5			
Analyze				
Evaluate	3			
Create				

Class Attendance 05

SFE-Semester Final Examination (Summative Assessment 60%), Total Marks: 60

Bloom's Category	TEST (60)
Remember	25
Understand	15
Apply	10
Analyze	10
Evaluate	
Create	

Course Code: 0922- 6105 (PHARM6105)		Year: First	Semester: First
Course Title: Public Health and Epidemiology			
Course Status: General Education (GEd)			
Credit: 2		Total Marks: 50	
Prerequisite(s): None			
Rationale	This course introduces core concepts of public health and epidemiology, focusing on disease prevention, health promotion, and population health analysis. Students will learn to apply epidemiological methods to assess health trends, identify risk factors, and inform public health policies, preparing them for roles in healthcare, research, and health system planning.		

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Explain applications and importance of epidemiology in clinical practice.
CLO2	Implement the knowledge of public health for the assessment and control as well as prevention of disease.
CLO3	Understand the epidemiological study protocol to regulate clinical trial.
CLO4	Evaluate drug use and ensure rational use of drug.
CLO5	Learn the ethics and professionalism of pharmacy profession.

Mapping of Course outcomes to program outcomes:

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	2	3			2		2			
CLO2	2	3			2					3
CLO3	2	3								
CLO4	2	3					3			
CLO5	2								3	

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

Sl No.	Course Content	CLOs
1	Introduction to Public Health: Genesis and Development of the concept, Healthcare versus Medical Care, Disease Control and Levels of Prevention, Determinants of health: biological, social, environmental, and behavioral, Health situation and Trends in Bangladesh, Role of pharmacists in public health	CLO1, CLO2, CLO3
2	Health Policy & Systems: National and global health policy, Health economics and resource allocation, Bangladesh's public health system structure	CLO2, CLO5
3	National Health Programs: An Overview of major National Health Programs(Immunization programs, Maternal and child health programs,Nutrition and health promotion campaigns, Other Government Health Programs/ Systems: Railways, Military	CLO2, CLO4
4	Global Health and Emerging Issues: Global burden of disease, Pandemic preparedness and response (e.g., COVID-19), Antimicrobial resistance (AMR), Climate change and health	CLO3
Section B		
5	Epidemiology: Origin and evaluation of epidemiology, need for pharmacoepidemiology, aims and applications.	CLO1, CLO4
6	Study Design in Epidemiology: Study Designs in Epidemiology, Observational studies, Interventional studies, Theoretical aspects of various methods and practical study of various methods, (Drug utilization review, case reports, case series, surveys of drug use, cross – sectional studies, cohort studies, case control studies, case –cohort studies, meta – analysis studies, spontaneous reporting, prescription event monitoring)	CLO3
7	Selected Special Applications of Pharmacoepidemiology: Studies of vaccine safety, hospital pharmacoepidemiology, pharmacoepidemiology and risk management, drug induced birth defects	CLO1, CLO5

Mapping CLOs with Teaching –Learning and Assessment Strategy		
CLOs	Teaching-Learning Strategy	Assessment Strategy
1–5	Lecture, Team Teaching	Quiz, and Class Test, assignments,
1–5	Problem-based Learning and Presentation,	Assignment and Final exam
1–5	Lecture and Group Discussion	Viva voce and Final exam

Learning Materials	
Recommended Readings	Thompson, J.E. (2009). *A Practical Guide to Contemporary Pharmacy Practice.* (3rd ed.). Philadelphia, USA: Lippincott Williams and Wilkins. Lauster, C.D. and Srivastava, S.B. (2013). *Fundamental Skills for Patient Care in Pharmacy Practice.* Burlington, USA: Jones & Bartlett Learning. Cipolle, R.J., Strand, L.M. and Morley, P.C. (2012). *Pharmaceutical Care Practice: The patient-centered approach to medication management services.* (3rd ed.). USA.
Supplementary Readings	Jones, R.M. (2015). *Patient Assessment in Pharmacy Practice.* (3rd ed.), Philadelphia, USA: Lippincott Williams & Wilkins. Cohen, M.R. (2006). *Medication Errors.* (2nd ed.). USA: American Pharmacists Association. Malone, P.R., Malone, M.J. and Park, S.K. (2017). *Drug Information: A Guide for Pharmacists.* (6th ed.). USA: McGraw-Hill Education. Abood, R.R. and Burns, K.A. (2015). Pharmacy Practice and the Law. (8th ed.). USA. Plake, K.S., Schafermeyer, K.W. and McCarthy, R.L. (2016). *McCarthy's Introduction to Health Care Delivery: A Primer for Pharmacists.* (6th ed.). Burlington, USA: Jones & Bartlett Learning. Harding, G. and Taylor, K.M.G. (2015). *Pharmacy Practice.* (2nd ed.). England: CRC press, Taylor and Francis group. Berger, B. (2009). *Communication Skills for Pharmacists: Building Relationships, Improving Patient Care.* (3rd ed.). USA: American Pharmacists Association. Beardsley, R.S., Kimberlin, C.L. and Tindall, W.N. (2011). *Communication Skills in Pharmacy Practice: A Practical Guide for Students and Practitioners.* (6th ed.). Lippincott Williams & Wilkins. Troy, D.B. and Beringer, P. (2005). *Remington: The Science and Practice of Pharmacy.* (21st ed.). Philadelphia, USA: Lippincott Williams & Wilkins.

ASSESSMENT PATTERN:

CA- Continuous Assessment (Formative Assessment) (40%), Total Marks: 40

Bloom's Category (35 out of 40)	Mid-Semester Exam (20%) Total Marks: 20	Assignment and/or Term paper preparation & Presentation and/or case study and/or Field work (10%). Total Marks: 10	Class Test and/or Quiz and/or In-course and/or Sudden Test (5%) Total Marks: 5	External Participation in Curricular/Co-Curricular Activities (0)
Remember	8			
Understand	4			
Apply	5			
Analyze				

Evaluate	3			
Create				

Class Attendance 05

SFE-Semester Final Examination (Summative Assessment 60%), Total Marks: 60

Bloom's Category	TEST (60)
Remember	25
Understand	15
Apply	10
Analyze	10
Evaluate	
Create	

Course Code: 0916-6106 (PHARM6106)		Year: First	Semester: First
	Course Title: Research Methodology		
	Course Status: Core		
	Credit: 2.0	Total Marks: 50	
	Prerequisite(s): None		
Rationale	The course intends to impart the knowledge of research among students so that they can understand the purpose of a research and justify the theory as well as the methodological decisions and finally explain the relationship between theory and research. The course will help to understand the concepts and techniques needed to describe and analyze research data, develop basic writing skills, ability to conduct possible calculations and making graphs.		

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Understand the fundamental research concept, research design and selecting appropriate research methods.
CLO2	Apply biologically relevant statistical analysis to research methodology and experimental data interpretation.
CLO3	Write scientific report, research article, reviewing and formatting of research report.

Mapping of Course outcomes to program outcomes:

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO
CLO1	2	3			2		2			
CLO2	2	3			2		2			3

CLO3	2	3			2		2			

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

Course Contents		Hrs.
1	Fundamentals of Research: Definition, Objectives of research, Research problem and non-research problem, Importance of research, Types of research, Research process, Hypothesis development.	5
2	Literature Survey and Documentation: Introduction and the role of the literature review in scientific research, Methods of literature survey, documentation procedure.	5
3	Methods of Research: Synopsys preparation, Survey and case study with advantages, limitations and techniques; collection of primary data, observation methods, interview method, questionnaire method, types of questionnaire and qualities of a good questionnaire, designing questionnaire and structured interview.	6
4	Data Processing and Analysis: Editing: Central editing, field editing, coding and decoding, tabulation, application of statistics, interpretation of results, graphical representation and problems of data processing, ANOVA, confidence limit, test of significance (F test, student t test), the Q test, statistical software used in data analysis (SPSS, MS-Excel, Statistical, GraphPad Prism).	6
5	Manuscript Preparation and Report Writing: Technique of scientific report writing, designing framework of a research report, drafting report, reviewing, editing, web page, references and bibliographies.	6

Mapping CLOs with Teaching –Learning and Assessment Strategy		
CLOs	Teaching-Learning Strategy	Assessment Strategy
1–3	Lecture and Team Teaching	Quiz and Class Test
1–3	Problem-based Learning and Presentation	Assignment and Final Exam
1–3	Lecture and Group Discussion	Viva voce and Final Exam

Learning Materials

Recommended Readings	1. Ranjit Kumar. (2019). *Research Methodology: A Step by Step Guide for Beginners* (5th ed.) SAGE Publications India. 2. C. R. Kothari. (2004). *Research Methodology: Methods and Techniques* (2nd ed.). New Age Int. (P) Ltd. Publishers, India.
Supplementary Readings	1. Balakrishnan. N. (2002) Statistical Methods and Practice. Prentice Hall of India. 2. Ferrold H. Zar. (2005) Biostatistical Analysis. (4th ed.). India: Pearson Education.

ASSESSMENT PATTERN:

CA- Continuous Assessment (Formative Assessment) (40%), Total Marks: 40

Bloom's Category (35 out of 40)	Mid-Semester Exam (20%) Total Marks: 20	Assignment and/or Term paper preparation & Presentation and/or case study and/or Field work (10%). Total Marks: 10	Class Test and/or Quiz and/or In-course and/or Sudden Test (5%) Total Marks: 5	External Participation in Curricular/Co-Curricular Activities (0)
Remember	8			
Understand	4			
Apply	5			
Analyze				
Evaluate	3			
Create				

*Class Attendance 05

SFE-Semester Final Examination (Summative Assessment 60%), Total Marks: 60

Bloom's Category	TEST (60)
Remember	25
Understand	15
Apply	10
Analyze	10
Evaluate	
Create	

Course Code: 0916-6107 (PHARM6107)	**Year:** First	**Semester:** First
Course Title: Pharmaceutical Analysis & Quality Control Lab		
Course Status: Core		
Credit: 2.0	Total Marks: 50	
Prerequisite(s): None		

Rationale	The intent of the course is to confer practical knowledge about the assay of some commonly used raw materials and dosage form using modern method of analysis.

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to-

CLO1	Learn estimating the potency of API and impurities by using different types of modern Techniques (HPLC
CLO2	Determine the quality and purity of drugs using different titrimetric techniques
CLO3	Identify of the compounds by spectroscopic methods.

Mapping of Course outcomes to program outcomes:

	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**
CLO1	2	3			2					
CLO2	2	3			2					
CLO3	2	3			2					

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	**Course content**	**Hrs**	**CLOs**
1.	Calibration of UV spectrometer through absorbance and wavelength checks, determination of effects of slit width and scanning speed on the UV absorption spectrum of a given drug.	**8**	**CLO1, CLO2**
2.	Assay of caffeine and sodium benzoate by simultaneous equation method and by absorbance, acquisition of 1H-NMR spectrum of organic molecules and assignments of the signals to the structures.	**8**	**CLO2, CLO3**
3.	Recording of IR absorption spectrum of a drug using KBR discs thin film techniques.	**8**	**CLO2, CLO3**
4.	Determination of paracetamol in plasma using reversed phase HPLC.	**8**	**CLO2, CLO3**
5.	Determination of amount of phenoberbitone in phenoberbitone tablets using UV absorption spectrum.	**8**	**CLO1, CLO2, CLO3**
6.	Gas chromatographic determination of the composition of fatty acid in oil.	**8**	**CLO1, CLO2, CLO3**

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning& Assessment Strategy:

Course Learning Outcome (CLO)	Teaching-Learning Strategies	Assessment Strategies
CLO1, CLO3	White board and Lab experiments.	Quiz, Collecting data through observation and experimentation.
CLO2	White board and Lab experiments.	Written test, Collecting data through observation and experimentation and drawing conclusions of the experiments.

ASSESSMENT PATTERN:

Continuous Assessment as Before Final (40%), Total Marks: 20

Bloom's Category Marks (15 out of 20)	Lab Performance (10)	Lab report writing (5)	External Participation in Curricular/Co-Curricular Activities (0)	Evaluator
Remember	2			Assigned course teacher
Understand	2	2		
Apply	2	1		
Analyze	2	1		
Evaluate	2	1		
Create				

*Lab Attendance 5 Marks

FA- Final Assessment (30 Marks):

Bloom's Category Marks (30)	Evaluation on Experiment			
	Introduction/ Principle writing (5)	Lab Final Experiment (20)	Viva-Voce (5)	Evaluator
Remember	2.5		1	1. Internal-1
Understand	2.5		2	2. Internal-2
Apply		2.5		3. External
Analyze		2.5	2	
Evaluate		5		
Create		10		

Course Code: 0916-6108 (PHARM6108)	**Year:** First	**Semester:** First
Course Title: Advanced Pharmacology and Toxicology Lab		
Course Status: Core		
Credit: 2.0	Total Marks: 50	
Prerequisite(s): None		
Rationale	The Advanced Pharmacology and Toxicology Lab is essential for understanding drug actions and toxicity through experimental studies. It helps students gain practical skills in evaluating drug safety, efficacy, and mechanisms of action. This lab supports drug development, rational use, and safety assessment, making it crucial for careers in pharmacological research and healthcare.	

Course Learning Outcomes (CLOs): at the end of the course, the student will be able to-

CLO1	understand the molecular mechanism of different receptor-mediated therapeutic effects.
CLO2	explain the pathophysiology and therapeutic management of different life-threatening diseases like cancer, ischemia, stroke, cancer and neurodegenerative diseases.
CLO3	explain the basic principles of drug toxicities and allergies and its impact on different organs. Advise patients on the safe and effective use of drugs to ensure rational uses.
CLO4	Identify the causative agents as well as understand the mechanisms, impacts and remedies of poisoning.
CLO5	Design and perform variable in vitro and in vivo experiments to know the toxicity profile of any drug or chemical.

Mapping of Course outcomes to program outcomes:

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	2	3			2					
CLO2	2	3			2					
CLO3	2	3			2	2			2	2
CLO4		3			2		2			
CLO5		3			2		2			

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	Course content	Hrs	CLOs

1	Determination of protein concentration by Lowry and Bradford method.	8	CLO2
2	Colorimetric analysis of different drugs from blood sample.	8	CLO2
3	Effect of agonists and antagonists on the contraction and relaxation response of the smooth muscles.	8	CLO3
4	Effects of drugs on heart.	8	CLO1
5	Study of liver and kidney toxicity.	8	CLO4
6	Toxic effects of drugs on hematological parameters.	8	CLO5
7	Histopathological study of different organs after drug administration.	8	CLO5

Mapping CLOs with Teaching –Learning and Assessment Strategy

CLOs	Teaching-Learning Strategy	Assessment Strategy
1–5	Lecture and Team Teaching	Quiz, Class Test and Final Exam
1–5	Problem-based Learning and Presentation	Assignment, Class Test and Final Exam
1–5	Lecture, Presentation and Group Discussion	Viva voce, Class Test and Final Exam

ASSESSMENT PATTERN:

Continuous Assessment as Before Final (40%), Total Marks: 20

Bloom's Category Marks (15 out of 20)	Lab Performance (10)	Lab Report Writing (5)	External Participation in Curricular/Co-Curricular Activities (0)	Evaluator
Remember				Assigned course teacher
Understand	2	2		
Apply	2	1		
Analyze	2	1		
Evaluate	2	1		
Create	2			

*Lab Attendance: 5 Marks

FA-Final Assessment (30 Marks):

	Evaluation on Experiment			
Bloom's Category Marks (30)	Introduction/ Principle Writing (5)	Lab Final Experiment (20)	Viva-Voce (5)	Evaluator
Remember	2.5			4. Internal-1
Understand	2.5		2	5. Internal-2

Apply		5		6. External
Analyze		5	2	
Evaluate		5	1	
Create		5		

Course Code: 0916-6109 (PHARM6109)	**Year:** First	**Term:** First
Course Title: Advanced Pharmaceutical Technology Lab		
Course Status: Core		
Credit: 2.0	**Total Marks**: 50	
Prerequisite(s): None		
Rationale	To develop skills for analyzing and interpreting pharmaceutical problems with hand on training in various analytical, instrumental and pharmaceutical unit operations that will make the graduates competent for starting their career as a pharmacist.	

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Understand the theory and practical aspects of pharmaceutical formulations.
CLO2	Know the methods of formulation and evaluation of different dosage forms.
CLO3	Uplift student's knowledge about drug delivery system and their formulation problems.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**
CLO1	**3**	**3**			**3**		**2**		**2**	
CLO2	**3**	**3**			**3**		**2**		**2**	
CLO3	**3**	**3**			**3**		**2**		**2**	

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	**Course Contents**	**Hrs**	**CLOs**
01	To study of effect of particle size, moisture content and lubricants on flow-ability and compressibility of powders	6	CLO1
02	Formulation, preparation and quality evaluation of suppositories.	6	CLO1, CLO2, CLO3
03	Formulation, preparation and quality evaluation of microcapsules.	6	CLO1, CLO2, CLO3
04	Formulation, preparation and quality evaluation of tablets.	6	CLO1, CLO2, CLO3

05	Formulation, preparation and quality evaluation of solid dispersion tablets.	8	CLO1, CLO2, CLO3
06	Formulation, preparation and quality evaluation of cream.	8	CLO1, CLO2, CLO3
07	Formulation, preparation and quality evaluation of ointment, gel.	4	CLO1, CLO2, CLO3
08	Formulation, preparation and quality evaluation of emulsion, elixir.	8	CLO1, CLO2, CLO3

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning& Assessment Strategy:

CLOs	Teaching-Learning Strategies	Assessment Strategies
CLO1	Lecture and Lab experiments.	Written test and drawing conclusions of the experiments
CLO2	Lecture and Lab experiments.	Written test and drawing conclusions of the experiments
CLO3	Lecture and Lab experiments.	Written test and drawing conclusions of the experiments

References books:

1. L. Lachman, H.A. Liebernan : The Theory and Practice of Industrial Pharmacy
2. S. J. Carter : Cooper and Gunn's Dispensing for Pharmaceutical Students
3. M. E. Aulton : Pharmaceutics, the Science of Dosage Form Design
4. H. C. Ansel and N. G. Popovich : Pharmaceutical Dosage Forms and Drug Delivery Systems

Supplementary Readings:

1. E. A. Rawlins : Bentley's Textbook of Pharmaceutics
2. Randy Hendrickson et. al. : Remington, The Science and Practice of Pharmacy

ASSESSMENT PATTERN:

Continuous Assessment as Before Final (40%), Total Marks: 20

Bloom's Category Marks (15 out of 20)	Lab Performance (10)	Lab Report Writing (5)	Evaluator
Remember	5	2	Assigned Course Teacher
Understand	5	2	
Apply	3	2	
Analyze	3		
Evaluate	2	2	
Create	2	2	

FA-Final Assessment (60%), Total Marks: 30

Bloom's Category **Marks (30)**	Evaluation on Experiment			
	Introduction/ Principle Writing (5)	Lab Final Experiment (20)	Viva Voce (5)	Evaluator
Remember	2		1	1. Internal-1
Understand	3		2	2. Internal-2
Apply		5		3. External
Analyze		5	2	
Evaluate		5		
Create		5		

Second Semester

Course Code: 0916-6201 (PHARM6201)	Year: First	Semester: Second	
Course Title: Advanced Clinical Pharmacy			
Course Status: Core			
Credit: 3.0	Total Marks: 100		
Prerequisite(s): None			
Rationale	Advanced Clinical Pharmacy focuses on optimizing medication therapy and improving patient outcomes through evidence-based, patient-centered care. It equips pharmacists with advanced skills in pharmacotherapy, clinical decision-making, and interdisciplinary collaboration. The study enhances the pharmacist's role in preventing drug-related problems, managing complex treatments, and contributing to public health efforts such as antimicrobial stewardship and chronic disease management.		

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Develop and integrate knowledge from foundational, pharmaceutical, and cli sciences to evaluate scientific literature, explain drug actions, assess and solve therapeutic problems, and advance patient-centered care
CLO2	Apply clinical reasoning to make evidence-based decisions in medication ther management and patient care
CLO3	Assess, design, implement, and monitor individualized therapeutic plans for patients, ensuring safe and effective medication use.
CLO4	Utilize health information systems and technology to support clinical decisior making and optimize medication management.
CLO5	Identify, prevent, and resolve medication-related problems to enhance patient safety and therapeutic outcomes

Mapping of Course outcomes to program outcomes:

	PLO1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO10
CLO1	2	2			2	2				
CLO2	2	2				3				2
CLO3	2	2			2	3				2
CLO4	2	3			2				3	
CLO5	2	2				3	2		2	3

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

Course Contents		Hrs	CLOs
Section A			
1	GI disorders: Aetiology, pathophysiology, clinical manifestations, principles of management and treatment of - GERD, ulcerative colitis, Crohn's disease and pseudomembranous colitis, ORT, super ORS, relevant case studies	4	CLO1
2	Neurological disorders: Aetiology, pathophysiology, clinical manifestations and clinical management of a) Alzheimer's disease, b) Parkinson's disease, c) Cerebrovascular disease and relevant case studies.	4	CLO1, CLO2
3	Cardiovascular disorders: Aetiology, pathophysiology, clinical manifestations and clinical management of a) Cardiac arrhythmia, b) Myocardial infarction, c) Thrombosis and relevant case studies.	4	CLO1, CLO2
4	Skin disorders: (a) Pressure sores and leg ulcers: Pathophysiology, aetiology, clinical signs and symptoms, investigations and treatment. (b) Drug induced skin disorders: diagnosis and treatment, relevant case studies.	5	CLO2
5	Rheumatoid disorders: (a) Rheumatoid arthritis and osteoarthritis: Epidemiology, aetiology, pathophysiology, clinical manifestations, investigations and treatment (b) Gout and hyperuricemia: Epidemiology, aetiology, pathophysiology, clinical manifestations, investigations and treatment, relevant case studies.	5	CLO3
6	Malignant disorders: Aetiology, pathophysiology, clinical manifestations, principles of management and treatment of major cancers including – colon, lung, ovarian, breast, prostate cancers and leukemia, relevant case studies.	5	CLO4
7	Racial, gender and ethnic differences in drug response: Origins of genetic differences among peoples, genetic variation within and between populations, the uses of racial categorization of medicine, interplay of genetic, environmental and cultural factors, genetic polymorphisms in drug metabolism, drug targets and disease pathways, racial and ethnic variation in polymorphisms in drug metabolism, clinical relevance of genetic	5	CLO4

	polymorphisms, examples of drugs showing varying effects among racial and ethnic groups.		
8	Patient counseling and interviewing techniques: What, who and when to counsel, format of counseling provided, counseling area, documentation of counseling, benefits and outcomes of counseling, counseling on non-prescription and prescription drugs, medication counseling tips, patients who should always be counseled and those who should be counseled at certain intervals, roles of pharmacists in reducing medication errors and in improving patient compliance and patient monitoring by effective counseling.	5	CLO4
9	Drug information services/resources: Needs for drug information, drug information resources and literature: primary, secondary and tertiary, information retrieval systems, example of online resources for drug related information.	5	CLO5

Mapping CLOs with Teaching –Learning and Assessment Strategy

CLOs	Mapping CLOs with Teaching –Learning and Assessment Strategy	
1-5	Teaching-Learning Strategy	Assessment Strategy
1-5	Lecture and Team Teaching	Quiz and Class Test
1-5	Problem-based Learning and Presentation	Assignment and Final Exam
1-5	Lecture and Group Discussion	Viva voce and Final Exam

Learning Materials	
Recommended Readings	1. Ranjit Kumar. (2019). *Research Methodology: A Step by Step Guide for Beginners* (5th ed.) SAGE Publications India. 2. C. R. Kothari. (2004). *Research Methodology: Methods and Techniques* (2nd ed.). New Age Int. (P) Ltd. Publishers, India.
Supplementary Readings	1. Balakrishnan. N. (2002) Statistical Methods and Practice. Prentice Hall of India. 2. Ferrold H. Zar. (2005) Biostatistical Analysis. (4th ed.). India: Pearson Education.

ASSESSMENT PATTERN:

CA- Continuous Assessment (Formative Assessment) (40%), Total Marks: 40

Bloom's Category (35 out of 40)	Mid-Semester Exam (20%)	Assignment and/or Term paper	Class Test and/or Quiz and/or In-course and/or Sudden Test	External Participation in Curricular/Co-

	Total Marks: 20	preparation & Presentation and/or case study and/or Field work (10%). Total Marks: 10	(5%) Total Marks: 5	Curricular Activities (0)
Remember	8			
Understand	4			
Apply	5			
Analyze				
Evaluate	3			
Create				

Class Attendance 05

SFE-Semester Final Examination (Summative Assessment 60%), Total Marks: 60

Bloom's Category	TEST (60)
Remember	25
Understand	15
Apply	10
Analyze	10
Evaluate	
Create	

Course Code: 0916- 6202 (PHARM6202)		Year: First	Semester: Second
Course Title: Advanced Molecular Biology			
Course Status: Core			
Credit: 3.0		Total Marks: 100	
Prerequisite(s): None			
Rationale	Molecular biology is the study of the biological processes at the molecular level and biotechnology is exploitation of biological systems or molecules to produce biological product. The objective of this course is to impart knowledge on the fundamental principles and techniques of molecular biology and biotechnology. The course will present the recent advances in gene cloning, generation of transgenic animal and their applications, gene therapy and biotechnological production of the current biotech products. The course will focus on the mechanisms of gene regulation in prokaryotes and eukaryotes, DNA damage and DNA repair systems in bacteria. The basic aspects of bioinformatics starting from sequence comparison tools to genome annotation to protein structure prediction methods will also be discussed.		

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Understand the principles and mechanisms of gene regulation in prokaryotic and eukaryotic cells along with the mechanism of DNA repairing.
CLO2	Use and apply knowledge of tools and strategies used in molecular biology and biotechnology for production of biotech products, and generation of transgenic animals
CLO3	Uplift student's knowledge about gene therapy, gene cloning for the detection of genes and finally for therapy for hereditary disease, gene therapy for cancer, gene therapy for HIV.
CLO4	Explain and demonstrate the basic concept of basic immunity, immunological responses, how it is triggered and role of cytokines in immunology, antigen-antibody interaction and the principle of immunoassays, MHC and their roles.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	3			2			3		
CLO2	2	3		1						
CLO3	3	3			3				2	
CLO4	3	3	2							

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	Course contents	Hrs	CLOs
01	Regulation of Gene Expression: a) Characterization and identification of cis and trans elements, methodology, mechanism of transcription repression by methylation, silencers. b) Regulation in Prokaryotes- Transcriptional regulation in prokaryotes (inducible and repressible system, positive regulation and negative regulation); Operon concept – lac., trp., and ara. Operons. c) Regulation in Eukaryotes: Regulatory strategies in Eukaryotes, Gene alteration (Gene loss, Gene amplification, Gene rearrangement: the joining of coding sequences)	9	CLO1, CLO2
02	Gene Replacement and Transgenic Animals: Cloning, purposes and risks of cloning, stem cells, definition & classification, generation and uses of transgenic & knockout/gene targeting animal models to study genetic diseases.	7	CLO1, CLO2,
03	Gene Therapy: Central concept of gene therapy, basic molecular mechanism of gene transfer, prerequisite of human gene therapy, biological basis of gene therapy strategies, vehicles for gene transfer, Antisence oligonucleotides and RNAi, clinical gene therapy studies, gene therapy for hereditary disease, gene therapy for cancer, gene therapy	9	CLO1, CLO2, CLO3,

	for HIV.		
04	Repair Mechanism of DNA: DNA damage, Mechanism of different types of DNA repair system in bacteria and their relation with carcinogenesis.	5	CLO1, CLO2, CLO3,
05	Basic Immunity: Natural and acquired immunity, Innate and adaptive immunity, Effector mechanisms of phagocytes, natural killer (NK) cells, T lymphocytes and B lymphocytes in immune responses; Cytokines and their roles in immune responses, General features of MHC and their roles in antigen presentation.	5	CLO4

Learning Materials	
Recommended Readings	Lodish et. al : Molecular Cell Biology Abbas, Lichtman, Pober : Cellular and Molecular Immunology
Supplementary Readings	Roitt, Brostoff, Male : Immunology Turner, Mclennam, Bate : Molecular Biology Alberts B *et. al* : The Cell : A molecular Approach Alberst *et. Al* : Molecular Biology of Cells *Other resources will be provided by respective teachers

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning& Assessment Strategy:

CLOs	Topic	Teaching-Learning Strategies	Assessment Strategies
CLO1, CLO2	Regulation of Gene Expression	Lecture, PPT Demonstration, Group discussion	Class test (Short Q and MCQ) assignment
CLO1, CLO2,	Gene Replacement and Transgenic Animals	Lecture, Online VDO, Discussion, Group study for problem analysis	Class test (Short Q and MCQ) Presentation
CLO1, CLO2, CLO3,	Gene Therapy	Lecture, Question-Answer session	Class test (Short Q and MCQ)
CLO1, CLO2,	Repair Mechanism of DNA	Lecture, Discussion, Question-Answer session	Class test (Short Q and MCQ)

CLO3,			
CLO4	Basic Immunity	Lecture, Discussion, Question-Answer session	Class test (Short Q and MCQ)

ASSESSMENT PATTERN:

CA- Continuous Assessment (Formative Assessment) (40%), Total Marks: 40

Bloom's Category (35 out of 40)	Mid-Semester Exam (20%) Total Marks: 20	Assignment and/or Term paper preparation & Presentation and/or case study and/or Field work (10%). Total Marks: 10	Class Test and/or Quiz and/or In-course and/or Sudden Test (5%) Total Marks: 5	External Participation in Curricular/Co-Curricular Activities (0)
Remember	8			
Understand	4			
Apply	5			
Analyze				
Evaluate	3			
Create				

*Class Attendance 05

SFE-Semester Final Examination (Summative Assessment 60%), Total Marks: 60

Bloom's Category	TEST (60)
Remember	25
Understand	15
Apply	10
Analyze	10
Evaluate	
Create	

Course Code: 0613-6203 (PHARM6203)	Year: First	Semester: Second
Course Title: Data Science and Programming		
Course Status: General Education (GEd)		
Credit: 3.0	Total Marks: 100	
Prerequisite(s): None		
Rationale	This course introduces students to the fundamentals of data handling, analysis, and programming for solving real-world problems. In line with the Outcome-Based Education (OBE) approach, it equips learners with practical skills in programming (Python/R), data visualization, and statistical interpretation. Students will gain the ability to clean, analyze, and interpret	

	datasets ethically, supporting evidence-based decision-making. The course builds a foundation for advanced fields such as machine learning, artificial intelligence, and big data analytics, thereby preparing graduates for academic research, industry applications, and life-long learning.

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Write and execute simple Python programs
CLO2	Perform data cleaning, manipulation, and visualization.
CLO3	Apply descriptive statistics, hypothesis testing, and regression using Python.
CLO4	Analyze small biomedical/pharmaceutical datasets.
CLO5	Communicate data-driven findings effectively.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	3			2			3		
CLO2	2	3		1						
CLO3	3	3			3				2	
CLO4	3	3	2							
CLO5	2	3				1				

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	Course contents	Hrs	CLOs
01	(i) Introduction to Data Science & Programming – Role of data science in pharmacy; introduction to Python and Jupyter Notebook; installation and environment setup. (ii) Programming Fundamentals – Variables, data types, operators, input/output, writing first programs.	6	CLO1, CLO3
02	(i) Control Structures – Conditional statements (if, if-else, nested); loops (for, while); simple practice tasks. (ii) Functions & Modules – Defining functions, parameters, return values; importing Python libraries (numpy, pandas, matplotlib).	6	CLO1, CLO2
03	(i) Working with Data – Reading/writing files (CSV, Excel); introduction to pandas DataFrames; handling missing data. (ii) Data Cleaning & Transformation – Filtering, grouping, merging datasets; dealing with null values; pharmaceutical dataset examples	6	CLO1, CLO2, CLO4
04	(i) Data Visualization – Basic plots with matplotlib and seaborn; histograms, bar charts, scatter plots, box plots. (ii) Descriptive Statistics – Mean, median, mode, variance, standard deviation; visualizing statistical summaries.	6	CLO5

05	(i) Probability & Distributions – Normal distribution, binomial, Poisson; application in drug response studies. (ii) Hypothesis Testing – t-tests, chi-square, ANOVA basics; applications in clinical trial	6	CLO3
06	(i) Correlation & Regression – Pearson correlation, linear regression; dose-response data analysis. (ii) Introduction to Machine Learning – Basic concepts: supervised vs unsupervised learning; simple classification example.	6	CLO5
07	(i) Case Studies in Pharmacy Data – Example datasets: drug efficacy, adverse drug reaction reports, biomedical experiment. (ii) Project Work & Presentation – Students analyze a small dataset and present findings.	6	CLO2, CLO4

Learning Materials	
Recommended Readings	1. Python for Data Analysis, 3rd Edition by Wes McKinney , 2. Python Crash Course, 2nd Edition by Eric Matthes, 3. Introduction to Machine Learning with Python by Andreas C. Müller & Sarah Guido,
Supplementary Readings	4. Practical Statistics for Data Scientists: 50+ Essential Concepts Using R and Python by Peter Bruce, Andrew Bruce, & Peter Gedeck, 5. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 3rd Edition by Aurélien Géron *Other resources will be provided by respective teachers

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning& Assessment Strategy:

CLOs	Topic	Teaching-Learning Strategies	Assessment Strategies
CLO1, CLO3	Introduction to Data Science & Programming Programming Fundamentals	Lecture, PPT Demonstration, Group discussion	Class test (Short Q and MCQ) assignment
CLO1, CLO2	Control Structures Functions & Modules	Lecture, Discussion, Group study for problem analysis	Class test (Short Q and MCQ) Presentation
CLO1,	Working with	Lecture, Question-Answer	Class test (Short Q and

CLO2, CLO4	Data Data Cleaning & Transformation	session	MCQ)
CLO5	Data Visualization Descriptive Statistics	Lecture, White board , Discussion, Question-Answer session	Class test (Short Q and MCQ)
CLO3	Probability & Distributions Hypothesis Testing	Lecture, Discussion, Question-Answer session	Class test (Short Q and MCQ)
CLO5	Correlation & Regression Introduction to Machine Learning	Lecture, White board, Discussion, Group study for problem analysis	Class test (Short Q and MCQ)
CL05	Case Studies in Pharmacy Data Project Work & Presentation	Problem analysis	Case report evaluation, Class test

ASSESSMENT PATTERN:

CA- Continuous Assessment (Formative Assessment) (40%), Total Marks: 40

Bloom's Category (35 out of 40)	Mid-Semester Exam (20%) Total Marks: 20	Assignment and/or Term paper preparation & Presentation and/or case study and/or Field work (10%). Total Marks: 10	Class Test and/or Quiz and/or In-course and/or Sudden Test (5%) Total Marks: 5	External Participation in Curricular/Co-Curricular Activities (0)
Remember	8			
Understand	4			
Apply	5			
Analyze				
Evaluate	3			
Create				

Class Attendance 05

SFE-Semester Final Examination (Summative Assessment 60%), Total Marks: 60

Bloom's Category	TEST (60)
Remember	25
Understand	15
Apply	10
Analyze	10
Evaluate	
Create	

Course Code: 0916-6204 (PHARM6204)	Year: First	Semester: Second
Course Title: Advanced Biopharmaceutics		
Course Status: Core		
Credit: 3.0	Total Marks: 100	
Prerequisite(s): None		
Rationale	This course develops advanced understanding of the biopharmaceutical and pharmacokinetic principles underlying drug product design. It trains students to evaluate formulation and physiological factors affecting bioavailability, establish in vitro–in vivo correlations, and apply PK/PD and physiologic modeling in modified-release drug development. The course equips learners with analytical and modeling skills needed for rational dosage form design and regulatory evaluation	

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Explain how physicochemical and formulation factors influence drug dissolution and bioavailability.
CLO2	Analyze dissolution testing methods and interpret in vitro–in vivo correlations.
CLO3	Apply pharmacokinetic principles to assess the impact of physiological parameters on drug clearance and distribution.
CLO4	Evaluate the design, advantages, limitations, and regulatory aspects of modified-release drug products.
CLO5	Utilize physiologic pharmacokinetic models (MRT, SMT, MAT, MDT) for dosage form selection and prediction of drug behavior.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3	3			2					
CLO2	2	3			3					
CLO3	3	3			3		3		2	
CLO4	3	3			3		3			

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	Course contents	Hrs	CLOs
01	Biopharmaceutics Considerations in Drug Product Design: Physicochemical nature of drugs, formulation factors affecting drug dissolution and bioavailability, in vitro dissolution testing, methods for testing enteric coated products, problems of variable control in dissolution testing, in vitro-in vivo correlation of dissolution and its failure of correlation, drug product-, patient- and route of drug administration considerations. Analysis of pharmacokinetics: Effects of relevant physiologic factors and alteration of physiologic parameters on drug distribution, calculation of the effect of various physiological parameters on hepatic, renal and total clearance of drugs. Pharmacokinetic and pharmacodynamics (PK-PD) relationship.	8	CLO1, CLO2
02	Biopharmaceutics of Modified Release Drug Products: Modified release drug products, biopharmaceutic factors, dosage form selection, drug release from matrix, advantages and disadvantages of extended-release products, kinetics of control release dosage forms, pharmacokinetic simulation of extended-release products, types of extended-release products, considerations in the evaluation of modified release products, regulatory studies for the evaluation of in vivo bioavailability data.	8	CLO1, CLO2,
03	Physiologic Pharmacokinetic Models: Application and limitation of physiologic pharmacokinetic models-interspecies scaling; mean residence time (MRT)-IV bolus dose, model independent and dependent nature of MRT; statistical moment theory (SMT); mean absorption time (MAT), mean dissolution time (MDT), selection of Pharmacokinetic models.	8	CLO1, CLO2, CLO3,
04	Fundamentals of Bioequivalence Studies: Introduction to Bioequivalence (Definition and importance, Role in generic drug development, Biopharmaceutics Classification System (BCS) and BE relevance) Regulatory Framework & Guidelines (USFDA, EMA, WHO, ICH, CDSCO perspectives, Biowaiver concept (BCS-based), Global harmonization efforts) Study Design Principles (Two-period, two-sequence crossover design, Replicated and parallel designs, Washout period and carryover effects, Sample size and power calculation, Randomization methods) Pharmacokinetic Parameters in BE (Primary parameters: Cmax, Tmax, AUC0–t, AUC0–∞, Secondary parameters: Kel, t½, MRT)	8	CLO3, CLO4

05	Applications and Advanced Considerations in Bioequivalence: Statistical Evaluation in BE [Data transformation (logarithmic), Confidence interval (90% CI approach), Acceptance limits (80–125%), Handling outliers and missing data, Concepts of population vs individual BE] In Vitro–In Vivo Correlation (IVIVC) [Concept and classifications, Role in establishing BE, Application modified/extended-release dosage forms] Special Considerations in BE [Highly variable drugs (HVDs) – scaled average BE, Narrow therapeutic index (NTI) drugs – stricter limits, Long half-life drugs – truncated AUC, Endogenous compounds – baseline correction] BE for Different Dosage Forms [Solid orals (IR vs MR), Injectables (solutions, suspensions), Transdermal and inhalation products, Ophthalmic, nasal, rectal, and topical formulations] Ethical & Clinical Aspects [Good Clinical Practice (GCP) compliance, Volunteer selection (healthy vs patient population), Informed consent and safety monitoring, Adverse event reporting] Case Studies & Emerging Trends Generic substitution and interchangeability	10	CLO3, CLO4

Learning Materials	
Recommended Readings	Shargel, L., Wu-Pong, S., & Yu, A. B. C. Applied Biopharmaceutics and Pharmacokinetics (7th ed.). McGraw-Hill. Gibaldi, M., & Perrier, D. Pharmacokinetics (2nd ed.). CRC Press.
Supplementary Readings	Amidon, G. L., et al. Pharmacokinetics and Pharmacodynamics: The Dynamics of Drug Absorption, Distribution, Action, and Elimination. Wiley. Wagner, J. G. Fundamentals of Clinical Pharmacokinetics. Drug Intelligence Publications. Dressman, J. B., & Reppas, C. In Vitro–In Vivo Correlations. Springer *Other resources will be provided by respective teachers

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning& Assessment Strategy:

CLOs	Topic	Teaching-Learning Strategies	Assessment Strategies
CLO1, CLO2	Biopharmaceutics Considerations in Drug Product Design	Lecture, PPT Demonstration, Group discussion	Class test (Short Q and MCQ) assignment
CLO1, CLO2,	Biopharmaceutics of Modified Release Drug Products	Lecture, Online VDO, Discussion, Group study for problem analysis	Class test (Short Q and MCQ) Presentation
CLO1, CLO2, CLO3,	Physiologic Pharmacokinetic Models:	Lecture, Question-Answer session	Class test (Short Q and MCQ)

CLO1, CLO2, CLO3,	Fundamentals of Bioequivalence Studies	Lecture, Discussion, Question-Answer session	Class test (Short Q and MCQ)
CLO4	Applications and Advanced Considerations in Bioequivalence:	Lecture, Discussion, Question-Answer session	Class test (Short Q and MCQ)

ASSESSMENT PATTERN:

CA- Continuous Assessment (Formative Assessment) (40%), Total Marks: 40

Bloom's Category (35 out of 40)	Mid-Semester Exam (20%) Total Marks: 20	Assignment and/or Term paper preparation & Presentation and/or case study and/or Field work (10%). Total Marks: 10	Class Test and/or Quiz and/or In-course and/or Sudden Test (5%) Total Marks: 5	External Participation in Curricular/Co-Curricular Activities (0)
Remember	8			
Understand	4			
Apply	5			
Analyze				
Evaluate	3			
Create				

*Class Attendance 05

SFE-Semester Final Examination (Summative Assessment 60%), Total Marks: 60

Bloom's Category	TEST (60)
Remember	25
Understand	15
Apply	10
Analyze	10
Evaluate	
Create	

Course Code: 0916-6205 **(PHARM6205)**	**Year:** First	**Semester:** Second
Course Title: Industrial Management & Regulatory Affairs		
Course Status: Core		
Credit: 2.0	**Total Marks**: 50	
Prerequisite(s): None		
Rationale	To acquire knowledge about pharmaceutical industries' management and leadership, risk management, operational efficiency and compliance with related national and global regulations	

Course Learning Outcomes (CLOs): at the end of the Course, the Student will be able to-

CLO1	Understand basic management techniques to develop future growth of pharmaceutical industry.
CLO2	Do resource management and analyze the policy for rationale drug use.
CLO3	Evaluate and analyze legislations of the pharmaceutical industry and their law and ethics.
CLO4	Learn about licensing and drug approval procedure for ensuring compliance and collaboration

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**
CLO1	3	2						3		
CLO2	3	2						3	2	
CLO3	3	2						2	3	
CLO4	3	2							3	

Course Plan Specifying Contents:

SL No	**Course Content**	**Hrs.**	**CLOs**
01	Management in pharmaceutical organization: Organizational Behavior, Strategic Management, Brand/Product Management, Sales & Distribution Management, Promotional Strategy, Market Segmentation, plus digital/relationship marketing (KOL & CRM), forecasting, inventory and order management, economic order volume, financial management, Manufacturing Management, Supply Chain & Logistics, Facilities & Equipment, Quality Systems (cGMP), Lean Six Sigma.	3	CLO1, CLO2

02	**cGMP of Pharmaceutical manufacturing:** ·Evolution and Principles of QA,QC & cGMP, WHO-GMP requirements, In-process quality control (IPQC), Audits and documentation		CLO2, CLO3
03	**Regulatory requirements for new product approval:** Regulatory requirements for product approvals obtaining New Drug Application (NDA), Abbreviated New Drug Application (ANDA) for generic drugs, regulatory inspection system, Approval process, stability study, BE study, post marketing surveillance.		CLO3, CLO4
04	**Harmonization of regulatory requirements:** The International Conference on Harmonization (ICH, guidelines to establish quality, safety and efficacy of drug substances and products. Study of ICH common technical documents (CTD), The International Organization for Standardization (ISO) 9000 series of quality systems standards, ISO 14000, licensing of premises.	12	CLO2, CLO4
05	**Globalization of drug industries:** GATT & WTO, WHO – certification, copyrights and patents, trade related aspects (TRIPS).	06	CLO3, CLO4

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning& Assessment Strategy:

CLOs	Topic	Teaching-Learning Strategies	Assessment Strategies
CLO1, CLO2	Management in pharmaceutical organization	Lecture, PPT Demonstration, Group discussion	Class test (Short Q and MCQ), assignment
CLO2, CLO3	cGMP of Pharmaceutical manufacturing:	Lecture, Discussion, Group study for problem analysis	Class test (Short Q and MCQ) Presentation
CLO3, CLO4	Regulatory requirements for new product approval:	Lecture, Question-Answer session	Class test (Short Q and MCQ)
CLO2, CLO4	Harmonization of regulatory requirements	Lecture, PPT Demonstration, Group discussion	Class test (Short Q and MCQ) Presentation
CLO3, CLO4	Globalization of drug industries:	Lecture, PPT Demonstration, Group discussion	

Text Book:

1. Stoner, J.F., Freeman, R.E. and Gilbert, D.R. (1994). *Management.* (6th ed.). Pearson.
2. Smarta, R.B. (1999). *Revitalizing Pharmaceutical Business: Innovative Marketing Approaches.* SAGE Publications Pvt. Ltd.
3. Huml, R.A. (2012). P*harmaceutical Competitive Intelligence for the Regulatory Affairs Professional (Briefs in Pharmaceuticals Science and Drug Development).* Springer

References books:

1. Cornish, W., Lleweyn, D. and Aplin, T. (2013). *Intellectual Property: Patents, Copyrights, Trademarks and Allied Rights*. (8th ed.). Sweet & Maxwell.
2. Guarino, R.A. (2017). *New Drug Approval Process.* (5th ed.). India: T&F.
3. WHO. (2004). Quality Assurance of Pharmaceutics Vol I & II. (Updated version). WHO

ASSESSMENT PATTERN:

Continuous Assessment as Before Final (40%), Total Marks: 20

Bloom's Category Marks (17.5 out of 20)	**Mid-Semester Exam (20%) Total: 10 Marks**	**Assignment and/or Term paper preparation & Presentation and/or case study and/or Field work (10%) Total: 5 Marks**	**Class Test and/or Quiz and/or In-course and/or Sudden Test (5%) Total: 5 Marks**	**External Participation in Curricular/Co-Curricular Activities (0)**
Remember	4		1	
Understand	2		1	
Apply	2		2	
Analyze	1	2	1	
Evaluate	1	1		
Create		2		

*** Class Attendance (5%)**: Total: 2.5 Marks

FA-Final Assessment (60%), Total Marks: 30

Bloom's Category 30 Marks	**Total: 30 Marks**
Remember	10
Understand	8
Apply	5
Analyze	5
Evaluate	2
Create	

Course Code: 0916-6206 **(PHARM 6206)**	**Year:** First	**Semester:** Second
Course Title: Pharmaceutical Documentation Lab		
Course Status: Core		
Credit: 2.0	Total Marks: 50	
Prerequisite(s): None		
Rationale	Proper pharmaceutical documentation ensures compliance with regulatory standards, enhances the quality and traceability of pharmaceutical products, and minimizes errors in manufacturing and clinical practices. This lab course enables students to gain hands-on experience in preparing, handling, and evaluating essential pharmaceutical documentation as per regulatory and Good Manufacturing Practices (GMP) standards.	

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Demonstrate understanding of the principles and purposes of pharmaceutical documentation in GMP and regulatory frameworks.
CLO2	Prepare key pharmaceutical documents including batch manufacturing records, SOPs, and logbooks in accordance with standard formats.
CLO3	Evaluate documentation for accuracy, completeness, and compliance with regulatory guidelines.
CLO4	Apply quality control principles in recording, maintaining, and auditing pharmaceutical documents.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**
CLO1	3	3							3	
CLO2	3	3					3	3		
CLO3								3	3	
CLO4		3			2					

Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	Course Content	Hrs.	CLOs
1	Introduction to Pharmaceutical Documentation Overview, importance, regulatory requirements (GMP, WHO, FDA, EMA, ICH)	4	CLO1
2	Types of Documentation: Primary (e.g., Batch records), Secondary (e.g., SOPs), Tertiary documents (e.g., policies)	4	CLO2

3	Good Documentation Practices (GDP) Hands-on practice: writing entries, corrections, use of ink, audit trails	4	CLO2
4	Standard Operating Procedures (SOPs): Drafting SOPs for simple lab or manufacturing operations	4	CLO2
5	Batch Manufacturing Records (BMRs) Creating BMRs for tablet or syrup production	4	CLO2
6	Batch Packaging Records (BPRs) Designing and reviewing BPRs including labeling and reconciliation	4	CLO2
7	Logbooks and Equipment Usage Records Filling logs for equipment, calibration, and cleaning	4	CLO2
8	Change Control and Deviations Documentation exercises on handling changes and deviations	4	CLO2
9	Quality Assurance Records Mock preparation of QA checklists and quality reports	4	CLO2
10	Document Review and Approval Process Simulated document audit and approval	4	CLO3
11	Case Study: GMP Violation Due to Documentation Errors Group analysis and reporting	8	CLO3, CLO4
12	Internal Assessment and Viva Voce Evaluation of documentation quality and understanding	8	CLO3, CLO4

Learning materials

1. **Good Documentation Practices –** World Health Organization (WHO) Technical Report Series
2. **Guidance for Industry: Q7 Good Manufacturing Practice Guide for Active Pharmaceutical Ingredients –** U.S. FDA / ICH
3. **Pharmaceutical Quality Assurance** by Manohar A. Potdar
4. **Pharmaceutical Documentation** by Javed Ali and Roopa Vemula
5. **Basic GMP Training Manual –** International Society for Pharmaceutical Engineering (ISPE)
6. **Quality Assurance of Pharmaceuticals: A Compendium of Guidelines and Related Materials –** WHO

ASSESSMENT PATTERN:

Continuous Assessment as Before Final (40%), Total Marks: 20

Bloom's Category Marks (15 out of 20)	**Lab Performance (10)**	**Lab Report Writing (5)**	**Evaluator**
Remember			Assigned course teacher
Understand	2	1	

Apply	3	2	
Analyze	3		
Evaluate	2	2	
Create			

***Lab Attendance:** 5 Marks

FA-Final Assessment (60%), Total Marks: 30

	Evaluation on Experiment			
Bloom's Category Marks (30)	Introduction/ Principle Writing (5)	Lab Final Experiment (20)	Viva Voce (5)	Evaluator
Remember			1	1. Internal-1
Understand	3		2	2. Internal-2
Apply	2	5		3. External
Analyze		5	2	
Evaluate		5		
Create		5		

Course Code: 0916-6207 (PHARM 6207)	**Year:** First	**Semester:** Second
Course Title: Advanced Biopharmaceutics Lab		
Course Status: Core		
Credit: 2.0	**Total Marks**: 50	
Prerequisite(s): None		
Rationale	This course provides practical and analytical skills for evaluating drug formulations and delivery systems. It emphasizes in vitro and in vivo testing, controlled release kinetics, bioavailability studies, and PK parameter estimation using both manual and software-based approaches. Students will gain hands-on knowledge of transdermal, aerosol, and special case pharmacokinetics, preparing them for research, formulation development, and regulatory assessments.	

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Perform dissolution, disintegration, and in vitro release testing for IR, SR, and CR products.
CLO2	Conduct and interpret in vivo bioavailability studies through drug level monitoring in biological fluids.

CLO3	Analyze controlled release kinetics (zero-order, first-order, Higuchi) and apply model fitting using graphs/software.
CLO4	Evaluate transdermal and aerosol dosage forms using standard diffusion and performance testing methods.
CLO5	Calculate and interpret pharmacokinetic parameters (Cmax, Tmax, AUC, t½, Vd, CL) including nonlinear PK data (e.g., phenytoin, ethanol).

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**	**PLO9**	**PLO10**
CLO1	3	3			2					
CLO2	2	3			2					
CLO3	3	3			3		3			
CLO4	2	3			2		2			
CLO5	2	3			2		2			

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

SL No.	**Course contents**	**Hrs**	**CLOs**
01	Dissolution and Disintegration Testing: USP/BP methods In vitro release profile for IR and SR products	6	CLO 1
02	In Vivo Bioavailability Studies: Determination of drug levels in plasma or urine Paracetamol in blood, aspirin in urine	6	CLO 2
03	Controlled Release Dosage Evaluation: SR/CR release kinetics: zero-order, first-order, Higuchi Model fitting using graphs or software	6	CLO 3
04	Transdermal Drug Delivery Evaluation: In vitro skin permeation using Franz diffusion cell TDDS dosage evaluation	6	CLO 4
05	Aerosol Product Evaluation: Particle size, plume geometry, content uniformity MDI/DPI testing	6	CLO 4

06	PK Parameter Calculation (Graphical & Software): One-compartment modeling Calculation of Cmax, Tmax, AUC, t½, Vd, CL	6	CLO 5
07	Nonlinear PK Data Interpretation: Simulated case: Phenytoin or ethanol Vmax/Km estimation	6	CLO 5
08	Special Case Studies & Presentations: Dosing adjustment in renal/hepatic dysfunction Effect of protein binding on distribution and clearance F	6	CLO 5

Learning Materials	
Recommended Readings	1. . Rowland, M., & Tozer, T. N. *Clinical Pharmacokinetics and Pharmacodynamics: Concep and Applications* (5th ed.). Wolters Kluwer. 2. Bolton, S., & Bon, C. *Pharmaceutical Statistics: Practical and Clinical Applications* (5th ec CRC Press.
Supplementary Readings	1. Dash, A. K., & Cudworth, G. C. *Pharmaceutical Statistics Using GraphPad Prism*. Springer. 2. Ritschel, W. A., & Kearns, G. L. *Handbook of Basic Pharmacokinetics*. American Pharmacists Association. 3. Kanfer, I., & Shargel, L. *Generic Drug Product Development: Solid Oral Dosage Forms*. CRC Press. *Other resources will be provided by respective teachers

Mapping Course Learning Outcomes (CLOs) with the Teaching-Learning& Assessment Strategy:

CLOs	**Topic**	**Teaching-Learning Strategies**	**Assessment Strategies**
CLO1	Dissolution and Disintegration Testing	Lecture, PPT Demonstration, Group discussion, Experiment	Class test (Short Q and MCQ), Viva, Experiment evaluation
CLO2	In Vivo Bioavailability Studies	Lecture, PPT Demonstration, Group discussion, Experiment	Class test (Short Q and MCQ), Viva, Experiment evaluation
CLO3	Controlled Release Dosage Evaluation:	Lecture, PPT Demonstration, Group discussion, Experiment	Class test (Short Q and MCQ), Viva, Experiment evaluation
CLO4	Transdermal Drug Delivery Evaluation:	Lecture, PPT Demonstration, Group discussion,	Class test (Short Q and MCQ), Viva,

		Experiment	Experiment evaluation
CLO4	Aerosol Product Evaluation	Lecture, PPT Demonstration, Group discussion, Experiment	Class test (Short Q and MCQ), Viva, Experiment evaluation
CLO5	PK Parameter Calculation (Graphical & Software):	Lecture, PPT Demonstration, Group discussion, Experiment	Class test (Short Q and MCQ), Viva, Experiment evaluation
CLO5	Nonlinear PK Data Interpretation:	Lecture, PPT Demonstration, Group discussion, Experiment	Class test (Short Q and MCQ), Viva, Experiment evaluation
CLO5	Special Case Studies & Presentations	Lecture, PPT Demonstration, Group discussion, Experiment	Class test (Short Q and MCQ), Viva, Experiment evaluation

ASSESSMENT PATTERN:

Continuous Assessment as Before Final (40%), Total Marks: 20

Bloom's Category Marks (15 out of 20)	**Lab Performance (10)**	**Lab Report Writing (5)**	**External Participation in Curricular/Co-Curricular Activities (0)**	**Evaluator**
Remember	2			Assigned course teacher
Understand	2			
Apply	2	2		
Analyze	2	1		
Evaluate	2	1		
Create		1		

***Lab Attendance**: 5 Marks

FA-Final Assessment (60%), Total Marks: 30

	Evaluation on Experiment			
Bloom's Category Marks (30)	Introduction/ Principle writing (5)	Lab Final Experiment (20)	Viva Voce (5)	Evaluator
Remember	2			1. Internal-1
Understand	3		2	2. Internal-2
Apply		5	2	3. External
Analyze		5	1	

Evaluate		5		
Create		5		

Course Code: 0916-6208	Year: First	Semester: Second
Course Title: Thesis Synopsis & Pre-Defense		
Course Status: Capstone		
Credit: 2.0	Total Marks: 50	
Prerequisite(s): None		
Rationale	Thesis synopsis & pre-defence ensure the upcoming thesis work will be well-planned, systematically executed, critically reviewed, and confidently defended.	

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Clarification of research direction – It helps to formulate research problem, objectives, hypotheses, and methodology in a concise form.
CLO2	Feasibility check – Ensures that the proposed study is achievable within the given timeframe, resources, and academic scope.
CLO3	Avoids duplication – Demonstrates novelty by reviewing prior literature and showing how the work fills a gap.
CLO4	Early feedback – Allows the advisory committee or department to identify weaknesses in research design, methodology, or results interpretation.
CLO5	Skill development – Gives a chance to practice in presenting the research clearly, defending choices, and handling critical questions.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	2	1	2	3	3			1		
CLO2	2			3	3		2	1	3	
CLO3		3		3			3		3	
CLO4	3									3
CLO5				3	3					3

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

Research synopsis:

Each thesis student of the department must be submitted the research synopsis (research proposal) as a computer typed report to the exam committee before the pre-defence date scheduled by the committee. It must contains-

Title of the thesis.

Introduction/ Background

Literature review

Research gap

Problem statement

Methodology
Tentative outcome of the research
Pre-defense: Thesis students must represent their synopsis or research proposal as Power Point Presentation. Besides, they have to defend their proposed work as question answer session.
SFE-Semester Final Examination (Summative Assessment), Total Marks: 50

Category	Marks
Synopsis/ Proposal	20
Pre-Defense	30

Bloom's Category	Synopsis (20)	Evaluator
Remember		Exam Committee
Understand		
Apply	5	
Analyze	5	
Evaluate		
Create	10	

Course Code: 0916-6209 (PHARM 6209)	**Year:** First	**Semester:** Second
Course Title: Viva Voce		
Course Status: Core		
Credit: 2.0	**Total Marks**: 50	
Prerequisite(s): None		
Rationale	The viva voce ensures that a Master's student in Pharmaceutical Sciences has not only acquired proper knowledge but can also critically defend, communicate, and contextualize their skills, preparing them for academic, industrial, or regulatory careers.	

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	Comprehensive Knowledge Assessment: The viva voce evaluates whether students have achieved a holistic understanding of core and advanced pharmaceutical sciences (pharmacology, pharmaceutics, medicinal chemistry, clinical pharmacy, regulatory affairs, etc.).
CLO2	Application to Real-World Problems: Non-thesis students are assessed on their ability to apply theoretical knowledge to practical scenarios such as drug design, formulation development, quality assurance, or regulatory decision-making.
CLO3	Critical Thinking and Problem-Solving: The viva tests students' reasoning ability, decision-making, and capability to analyze case studies or problem statements.
CLO4	Communication and Professional Skills: Oral defense develops and evaluates communication skills, essential for teamwork, regulatory presentations, or patient counseling in professional settings.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	3									2
CLO2	3	3	2							
CLO3		3	3				2			
CLO4			3						3	

(Level of correlation: 3-High, 2-Medium, 1-Low)

FA-Final Assessment Total Marks: 50

Bloom's Category Marks (50)	Viva-Voce (50 Marks)	Evaluator: Exam Committee Members
Remember	10	1. Internal
Understand	10	2. Internal
Apply	10	3. Internal
Analyze	10	4. External Member
Evaluate	10	
Create		

Third Semester

Course Code: 0916-6301 (PHARM6301)	Year: Second	Semester: First
Course Title: Dissertation		
Course Status: Capstone		
Credit: 12.0		
Prerequisite(s): None		
Rationale	The rationale of a dissertation is to demonstrate the researcher's ability to conduct original, rigorous, and meaningful research, while contributing to academic knowledge and professional practice.	

Course Learning Outcomes (CLOs): At the end of the course, the student will be able to-

CLO1	It will build the ability of students to identify a research problem, formulate objectives, and design a systematic study.
CLO2	It will assist for critical thinking, and research skills acquired during the academic program.

CLO3	It serves as evidence of independent scholarly work
CLO4	It identifies and addresses research gaps in a specific field of study.
CLO5	It provides recommendations or solutions that may influence policy, practice, or further research.
CLO6	It represents mastery in using appropriate research methodologies, tools, and analytical techniques
CLO7	Builds expertise that can be applied in professional practice, industry, or policymaking.

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1		3			3					
CLO2					3		3			3
CLO3					3		3		3	
CLO4	3				3		3			
CLO5			3			3		8		
CLO6				3	3					
CLO7		2	3			3				3

(Level of correlation: 3-High, 2-Medium, 1-Low)

Course Plan Specifying Contents:

Thesis students of the department must submit their Dissertation (Thesis Paper) as a computer typed report to the exam committee before the Thesis defenses date scheduled by the committee. It must contains-

- ✓ Title of the thesis.
- ✓ Introduction/ Background
- ✓ Literature review
- ✓ Research gap
- ✓ Problem statement
- ✓ Detailed methods and materials used in the thesis
- ✓ Results
- ✓ Discussion
- ✓ Conclusion
- ✓ Limitation
- ✓ Future research direction
- ✓ Bibliography

SFE-Semester Final Examination (Summative Assessment 100%), Total Marks: 100

Dissertation report evaluation Total Marks: 80

Viva-voce of Dissertation: 20

Dissertation report evaluation

Bloom's Category	Examination (80)	Evaluator
Remember		Tow external teacher from other universities
Understand		
Apply	25	
Analyze	25	
Evaluate	50	
Create	100	

Viva Voce evaluation

Bloom's Category	Evaluation (20)	Evaluator
Remember		Exam Committee
Understand	5	
Apply	5	
Analyze	5	
Evaluate	5	
Create		

PART D

1. **Teaching- Learning Strategy:**

   Teaching learning strategy refers to the immediate performance of the learners in relation to specific instruction under certain method and level of accuracy. The following teaching method used by the course teacher: Recommended text books including web-based materials, lecture sheet, Class discussion, recitation oral question answer session, case study, presentation each chapter in the course by the student, problem-based learning and solving, Group work, field visit, Individual work, assignment, multimedia projector used for lecture and example cooperative learning, Debate on current issues.

2. **Assessment Strategy:**

   Students can also assess their own work in the class, midterm, assignment and their assessment can be a portion of the final grade. This method has educational value as learning to assess one's own progress contributes to the university's goal of preparing our students to be life-long learners.

Evaluation of the student in this course as follows:

Process of evaluation	**Marks**
Class attendance	5%
Assignment and Quiz-test	5%
Term paper presentation	10%
Two mid-term examination (10X2)	20%
Final examination	60%
Total	**100%**

Grading policy of the total 100 marks on the above evaluation process awarded by the semester:

Marks Range	**Letter Grade**	**Grade Point**	**Interpretation**
80+	A+	4.00	Outstanding
75-79	A	3.75	Excellent
70-74	A-	3.50	Very Good
65-69	B+	3.25	Good
60-64	B	3.00	Average
55-59	B-	2.75	Below Average
50-54	C+	2.50	Fair

45-49	C	2.25	Poor
40-44	D	2.00	Minimum Pass
Below 40	F	0	Fail
----------	I	--------	Incomplete
----------	W	--------	Withdrawn

Class Year	**Number of Courses**		**Total Course Units**	**Credit Hours**
	First Semester	**Second Semester**		
Course Works				
First Year	06	05	11	32
Second Year	06	05	11	31
Third Year	08	06	13	40
Fourth Year	08	06	14	38
Viva-Voce and Internship/Project Paper				
Viva-Voce				09
Project Report				03
TOTAL				153

Medium of Instruction

The medium of instruction of the program of different academic faculties shall be English and /or Bangla. The Academic Committee of the concerned department shall have the right to decide the medium of instruction.

Examination Entry Requirements

A student will be allowed to take part in Semester Final Examination if s/he fulfills the following conditions:

a. If the student has registered for the concerned semester in due time.

b. If s/he has the required percentage of attendance in each course lecture.

c. If the student has paid all dues (registration fees/tuition fees/other charges) applicable to university administration/residential hall administration/discipline administration.

d. If the student has not been instructed by the Disciplinary Board / Examination Disciplinary Committee to refrain from taking part in the examination.

Evaluation System

a. Theoretical Course: Each theoretical course offered should be composed of either 50 or 100 marks (each 50 marks course consisting of 2 credit point). The proportion of the total marks of a particular course shall be distributed as follows:

Continuous Assessment /Before-Final Assessment	40%
Semester-Final Examination	60%
Total =	100%

b. Continuous Assessment: Marks allocated for before-final assessment shall be distributed as follows:

i. **Internal Evolution:**

a) Mid-Semester examination (At least Two mid-semester exams.) 20%

b) Class Test and/or Quiz and/or In-course and/or Sudden test and/or tutorial and/or Assignment and/or Term paper preparation & presentation/ Case study and/or practical and/or Field work [1] 15%

Class Attendance 5%

Total = 40%

ii. **Class Attendance:** The marks allocated for class attendance shall be given as following proportions:

Attendance	Marks
90% and above	100%
85% to less than 90%	90%
80% to less than 85%	80%
75% to less than 80%	70%
70% to less than 75%	60%

[1] Concerned department and/or course teacher will decide the allocation of this mark in different activities.

65% to less than 70%	50%
60% to less than 65%	40%
Less than 60%	00%

iii. **Before-final Assessment Report:**

- At the end of the course, the course teacher shall calculate the total marks of the continuous assessment (including class attendance) and prepare a marks sheet. The answer scripts of the mid-term examinations should be shown to the students as it is valuable for their learning process. The before-final assessment marks have to be submitted to the Controller of the Examinations before the suspension of class for the semester final examinations.
- The course teacher shall also submit the class attendance marks along with the register/documents to the Chairman of the Department. The chairman will take into consideration the attendance mark while forwarding the examination entry forms to the Controller of the Examinations.

c. Class-Attendance Requirements to Appear in the Semester Final Examination:

i. If class attendance of any student at any course is below 60%, but in the range of 40% to 59%, s/he will be allowed to attend the examination only with the recommendation of the course teacher and approval of the chairman of the department. In such cases the student will have to pay a fine as fixed by the authority/department.

ii. A student with class attendance of less than 40% in any course will be debarred from appearing in the Final Examination.

b. Letter Grade and Grade point: Total marks obtained in each course, oral (viva-voce) examination and practical courses shall be converted into LG (Letter Grade) and GP (Grade point) as follows:

Numerical Grade	**Letter Grade**		**Grade point**	**Interpretation**
80% and above	A+	(A Plus)	4.00	Outstanding
75% to less than 80%	A	(A regular)	3.75	Excellent
70% to less than 75%	A-	(A minus)	3.50	Very Good
65% to less than 70%	B+	(B Plus)	3.25	Good
60% to less than 65%	B	(B regular)	3.00	Satisfactory
55% to less than 60%	B-	(B minus)	2.75	Below Satisfactory

50% to less than 55%	C+	(C Plus)	2.50	Average
45% to less than 50%	C	(C regular)	2.25	Pass
40% to less than 45%	D	.....	2.00	Poor
Less than 40%	F	.....	0.00	Fail

* In the Transcript/Grade sheet, only the Letter Grade and the Corresponding Grade points, and final CGPA (in the 8th Semester), not the numerical marks, will be shown.

Promotion[2]

a. For promotion from one semester to the next class tear a student is required to earn minimum CGPA of 2.00 in each class year on condition that s/he has passed the viva-voce.

b. If anybody is absent from the viva-voce on any valid ground a viva-voce may be arranged for him/her on condition that s/he will bear all expenses of the viva. In such case s/he has to apply to chairman of the department within 15 days after the viva-voce exam.

Degree requirements

a. For Bachelor (Honors) degree/BBA degree, a student requires to:

i. Earn required number of total credit points successfully;
ii. Earn a minimum CGPA of 2.25; and
iii. Complete the program within six academic years from her/his 1st admission to the program.

b. Award of (Pass) Degree:

i. A student who fails to secure a minimum CGPA of 2.25 after completing eighth semester final examination but succeeds in securing a CGPA between 2.00 and 2.25 will be eligible for a Pass Degree.

Improvement of grades

Only the removal of 'F' (Fail) in any course shall be allowed. Removal of 'F' in any course is permitted sitting in the final examination only for two (2) times in subsequent two semesters excluding the regular examination. In such cases results shall be one grade down (unless the result is a "D" grade) in tabulation and calculation of CGPA.

[2] For the session 2006-07 to 2010-11 the promotion rule is different and is attached in Annex-1 .

উপরোক্ত পরীক্ষাবিধির স্থলে ২০১১-২০১২ শিক্ষাবর্ষ থেকে নিম্নোক্ত বিধিকমিটি কর্তৃক সুপারিশকরাহলো- ৩২তম একাডেমিককাউন্সিলসভারসম্পূরক- ৮ এর সুপারিশ

Improvement of grades

- **i.** A student having earned 'F' grade in any course in any semester shall be required to remove the 'F' grade. Removal of 'F' grade in any course is permitted only for two (2) times excluding the regular examination. This has to be done within his academic tenure.
- **ii.** A student having earned letter grade **'B-' (GP- 2.75)** or below in any course may be allowed to improve the grade by appearing in the semester-final examination with the next available batch[3]. S/he can avail this opportunity only once for a course. In such case the best GPA from the improvement or regular examination/concern subject shall be calculated for tabulation. In such cases results shall be one grade down (unless the result is a 'D' grade) in tabulation calculation of CGPA.
- **iii.** A student having earned 'F' grade in any course in any semester shall be required to remove the 'F' grade. Removal of 'F' grade in any course is permitted only for two (2) times excluding the regular examination. Which has to be done with subsequent available batches.
- **iv.** A student having earned letter grade **'B-' (GP- 2.75)** or below in any course may be allowed to improve the grade by appearing in the semester-final examination with the next available batch[2]. S/he can avail this opportunity only once for a course. In such case the best GPA from the improvement or regular examination/concern subject shall be calculated for tabulation.
- **v.** A student willing to improve grade should apply to the controller of examination through the chairman of the department within 01 (one) week after the publication of the results of the semester.
- **vi.** No improvement shall be allowed in continuous assessment (mid-term/class-test/assignment/ fieldwork/ monograph/ project/ practical/case-study/term-paper/quiz test/etc.).
- **vii.** The concerned (current) examination committee to that semester will take necessary actions to arrange the improvement examinations, tabulation and posting of marks.

* If a student gets one month after his result publication to sit for the examination with a batch that batch will be considered as available batch for her/his.

Re-admission

- **a.** A student failing to earn the requisite credit points for promotion (clause 10) from one semester to the next may seek readmission with the following batch.

b. For readmission a student shall have to apply within one month after the announcement of the result of the concerned semester.

Drop out

a. If a student re-admitted twice in any semester fails to earn minimum required credits [4] for promotion shall be dropped out from the program.

b. If a student fails to earn required total credit points within six academic years since admissions, s/he will be dropped-out from the program and will no more be allowed to continue his/her studentship with other programs.

Credit transfer

No Credit transfer from any other program /University /Institutions to the Comilla University is allowed.

Promotion

a. Promotion will be declared on academic year basis.

b. For promotion from one class year to next class year, a student is required to earn minimum CGPA of 2.00 in each class year. (**28 তম একাডেমিক কাউন্সিল সংযোজনকৃত condition that s/he has passed the Viva-voce.)**

Improvement of grades

viii. Student who did not get the opportunity of removing 'F' in any course as per rule 12(i) shall be allowed to sit for a special semester examination. This will be allowed only for the course in 7th and 8th semester. In special cases this opportunity would be allowed for courses in semester 5th and 6th. In such cases student have to apply to the Chairman of the department within one week after publication of the 8th semester result. The Chairman of department shall take necessary administrative measures for arranging the special semester examinations by the respective 4th year examinations committee. All the expenses relating to this examination have to be carried by the candidate(s).

ix. A student having earned letter grade of less than 'B' (less than GP 3.00) in any course may be allowed to improve the grade by appearing in the semester-final examination with the next available batch[5]. S/he can avail this opportunity only once for a course.

x. No improvement will be allowed in 8th semester.

xi. For appearing in the improvement examination, a student shall have to pay fees for the course prescribed for the purpose.

[4] For the session 2006-07 to 2010-11 'the minimum required CGPA in each class year'.

[5] If a student gets one month after his result publication to sit for the examination with a batch that batch will be considered as available batch for her/his.

xii. A student willing to improve grade should apply to the controller of examination through the chairman of the department within 01 (one) week after the publication of the results of the semester.

xiii. No improvement shall be allowed in continuous assessment (mid-term/class-test/ assignment/ fieldwork/ monograph/ project/ practical/ case-study/ term-paper/ quiz test/etc.).

xiv. The concerned (current) for that semester will take necessary actions to arrange the improvement examinations, tabulation and posting the marks.

Annex-2 : Rules regarding Examination Offences and Disciplinary Action

Formation of Examination Disciplinary Committee:

1. Disciplinary action against candidates involved in Examination offences shall be taken by the Syndicate on recommendation of the Examination Discipline Committee as constituted below:

(i)	The Vice-Chancellor	Chairman
(ii)	The Deans of the Faculties	Members
(iii)	Two provosts to be nominated by the Vice-Chancellor	Members
(iv)	Three teachers of the University to be nominated by the Vice-Chancellor	Members
(v)	Two Chairman be nominated by Vice-Chancellor	Members
(vi)	Proctor	Member
(vii)	The Controller of Examinations	Members-Secretary

2. Members other than Vice-Chancellor members shall hold office for a period of one year after formation of the committee.
3. Five members shall form the quorum
4. The following shall be considered Examination offences:

(a) Communication or attempt to communicate with any other candidate in the Examination Hall.

(b) Writing in the Examination Hall anything incriminating on the question paper or admit card, table, desk, bench, etc.

(c) Possession of incriminating notes, books, map, chart, slip, chit or any other documents, in the examination hall.

(d) Creating or inciting to create any nuisance or disturbance in the Examination Hall.

(e) Copying or attempt to copy from incriminating documents or from another's script, or from any writing on the person or wearing apparel while appearing at the Examination.

(f) Taking the script out of the Examination Hall.

(g) Changing the script or inserting unauthorized sheets in the script.

(h) Approaching or influencing the Invigilator, Examiners, or members of the Examination Committee, Tabulators to gain undue favor or advantage in connection with Examination.

(i) Using abusive language or holding out threat to the invigilator or any other person engaged on Examination duty inside or outside the Examination Hall.

(j) Assault or attempt to assault or use criminal force against Chief Invigilator or the Invigilator or any other person engaged on Examination duty inside or outside the Examination Hall.

5. In making its recommendation, the Examination Discipline Committee shall follow the following rules.

(a) Candidates found guilty of offence or offences falling under Section 4 (a), (b) and (c) shall be penalized with the cancellation of the Examination at which they commit offence or offences.

(b) Candidates found guilty of offence falling under Section 4(d) shall in addition to cancellation of the Examination at which the offence is committed, be debarred from appearing at the subsequent Examination.

(c) Candidates found guilty of offences falling under Section 4(e), (f), (g) and (h) shall, in addition to the cancellation of the Examination at which the offence is committed, be debarred from appearing at two or three subsequent Examinations or from that semester depending on the gravity of the offence.

(d) Candidates found guilty of offence falling under Section 4 (i) and (j) shall, in addition to the cancellation of the Examination at which the offence is committed, be debarred from appearing at the subsequent Examinations of the one or two semesters depending on the gravity of the offence.

6. Any other offence not covered by the above rules shall be dealt with by the Syndicate on the recommendation of the Examination Discipline Committee as it deems fit.

7. Candidates committing offences except those falling under Section 4 (a), (b), (c), (d), (e) and (i) shall not be allowed to continue to appear in that paper, and their scripts shall not be sent for evaluation but shall be sent separately to the Controller of Examinations in sealed cover.

8. The Invigilator shall submit separate report for each case, regarding the nature of the offence and the circumstances in which it is alleged to have been committed, with all supporting documents underlining the coped portion in the script as well as in the incriminating documents in the case of actual copying.

9. The Chief Invigilator of the Examination Center shall forward the report of the Invigilators and relevant documents with his expressed opinion along with the script. These reports and documents will be preserved by the Controller of Examinations for a period of at least six months from the date of the publication of the penalty list.

10. The following procedure shall be adopted in dealing with cases of candidates involved in Examination offences:

(i) On receipt of reports from the Chief Invigilator of the Examination Center, the Controller of Examinations shall call for explanation from the candidate concerned asking him why disciplinary action shall not be taken against him for the alleged committed of examination offence. Such show-cause notice must be sent by registered post to his permanent address as recorded in the Examination Entry Form registration form. The candidate must be given ten days' time from the date of issue of show-cause notice to submit his explanation. If no explanation is received within the prescribed time limit, the Examination Disciplinary Committee may take necessary disciplinary action.

(ii) The controller of Examinations will then place all relevant documents of the case together with the explanation of the candidate to the Examination Discipline Committee for consideration. The proceedings of the Discipline Committee shall be forwarded to the registrar for reporting it before the Syndicate.

11. Provided that in any emergency, notwithstanding the provisions of the Rules and Regulations on the subject, the Vice-Chancellor may in

exercise of the powers vested in him in terms of clause (j) of Section 11 [of the Comilla University Act, 2006; take any disciplinary action considered necessary in the circumstances and report the same to the Syndicate for information.

Annex-5: Computation of Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA)

The GPA and CGPA will be computed in following formula:

$$GPA = \frac{\Sigma \text{ (Credit} \times \text{Grade Points Secured)}}{\text{Total Credits Offered in the Semester}^{6}}$$

$$CGPA = \frac{\Sigma \text{ (Credit} \times \text{Grade Points Secured)}}{\text{Total Number of Credits offered in the whole program}}$$

Dean's Honor list, Dean's Merit list and Honor Society

Students who have earned GPA of 4.00 in any semester shall be included in the Dean's Merit list of the semester. Students securing a CGPA of at least 3.90 shall be included in the Dean's Honor list of the year.

Calculation of Cumulative Grade Point Average (CGPA)

Example:

First Semester

Course	(1) No. of Credits	(2) Grade Awarded	(3) Total Grade Points	(4) = (1) × (3) Grade Points Secured
PHARM-6101	3	B	3.00	9.00
PHARM-6102	3	A+	4.00	12.00
PHARM-	3	D	2.00	6.00

[6] For Session 2006-07 to 2010-11 'Total Credits offered in the Year'.

6103				
PHARM-6104	3	A	3.75	11.25
PHARM-6105	3	A–	3.50	10.50
PHARM-6106	3	A	3.75	11.25
Total	**18**			**60.00**

SGPA = Total Grade Points Secured ÷ Total Number of Credits = 60.00 ÷ 18 = 3.33

First Year Second Semester

Course	**(1) No. of Credits**	**(2) Grade Awarded**	**(3) Total Grade Points**	**(4) = (1) × (3) Grade Points Secured**
PHARM-6201	3	B	3.00	9.00
PHARM-6202	3	C+	2.50	7.50
PHARM-6203	3	D	2.00	6.00
PHARM-6204	3	A	3.75	11.25
PHARM-6205	3	A+	4.00	12.00
Viva-voce	2	A	3.75	7.50
Total	**17**			**53.25**

SGPA = Total Grade Points Secured ÷ Total Number of Credits = 53.25 ÷ 17 = 3.13

Cumulative Data:

Total Credit = (18+ 17) = 35

Total Grade Points Secured = (**60.00**+ **53.25**) = 113.25

Cumulative Grade Point Average (CGPA) = 113.25 ÷ 35 = 3.24

Comilla University

Faculty of Science

Department of Pharmacy

M. Pharm OBE Curriculum
Academic Session: 2023-2024

Particulars	Credits
Thesis Group	
Courses – 10 Courses	28
Thesis Synopsis & Pre-Defence	2
Dissertation	12
Total	**42**
Non-Thesis Group	
Courses – 10 Courses	28
Pharmacy Lab -5 Courses	10
Viva voce	2
Total	**40**

Pharmacy Alumni Association
Convener Committee

SL.	Name	Designation
01	Md. Saddam Hossain	Convener
02	Joynta Mazumder	Member
03	Md. Ashraful Rahman Bhuiyan	Member
04	Kawsar Hamid	Member
05	Meherun Nesa	Member
06	Md. Shajalal Reza	Member
07	Akil Mahmud	Member Secretary