CURRICULUM

BACHELOR OF PHARMACY PROGRAM

DEPARTMENT OF PHARMACY

UAP

Overview of the University of Asia Pacific (UAP)

University of Asia Pacific (UAP) is one of the first generation private universities in Bangladesh which came into being in 1996. The curriculum of UAP has been approved by the University Grant Commission (UGC) of the Government of the Peoples' Republic of Bangladesh. The university started its journey offering four-year bachelor's programs in Computer Science and Engineering and Business Administration. UAP has been sponsored by University of Asia Pacific foundation, a non-profit and noncommercial organization based in Dhaka, Bangladesh. The aim of the foundation is to impart high quality educational programs where next generation will be successful to be innovative, skilled and professionals to cope with the demands of the world. As a result, the graduates will be able to make a positive contribution to the society. Eminent educationists, industrialists, businessmen, social workers and administrators established the foundation for higher cause of building the nation by qualified, knowledgeable and skilled graduates. Late Hedayet Ahmed, former secretary to the government of Bangladesh, Ambassador to Saudi Arabia, and former director of UNESCO for Asia Pacific Region in Bangkok was the founder Vice Chancellor of the university. After his demise, Mr. A. S. M. Shahjahan, Ex-IGP and former Advisor of the Caretaker Government played the role of Vice Chancellor till March, 2003. Prof. Dr. M. R. Kabir was acting Vice Chancellor till September 2004. The appointment of Prof. Dr. Abdul Matin Patwari as the Vice Chancellor on 7 September, 2004 was a great breakthrough for UAP. A renowned educationist, former Vice Chancellor of BUET and DG IIT (IUT) who served as Vice Chancellor and Chief executive with distinction for more than twenty three years to achieve the record of longest serving Vice chancellor and Chief Executive among all Commonwealth countries. In 2012, invaluable responsibility of Vice Chancellor was handed over to the icon in Engineering and Technology to none other but to Prof. Dr. Jamilur Reza Choudhury. He is well known as an eminent educationist, engineer and former Advisor to the care taker Government. At present, UAP is privileged and honored to have him as the Vice Chancellor who in 2017 had also received "AkhushePadak" recognized as the highest honor and reward nationally.

Programs Offered by the Entity: The following programs are currently offered by the University of Asia Pacific:

Undergraduate Programs	Bachelor of Architecture
	Bachelor of Business Administration
	Bachelor of Sciences in Civil Engineering
	Bachelor of Sciences in Computer Science and Engineering
	Bachelor of Sciences in Electrical and Electronic Engineering

	Bachelor of Arts in English
	Bachelor of Laws (Regular and External)
	Bachelor of Sciences in Mathematics
	Bachelor of Pharmacy
Graduate Programs	Masters of Business Administration (Regular and Executive)
	Masters of Science in Civil Engineering
	Masters of Science in Computer Science and Engineering
	Master of Arts in English
	Master of Laws (Regular and External)
	Masters of Science in Pharmaceutical Technology

UAP Vision: UAP holds steadfastly its passion to do better and better in fulfilling our young generation's needs and aspirations for a caring and quality education in casting their future career and become a desirable destination for an identity.

UAP Mission: UAP mission is to offer best possible education to our young generation. Towards the mission, UAP continues to develop a sustained culture of ascending to a top-tier of vibrant academic environment; maintain and foster well qualified faculty, provide adequate research support for cutting-edge research in-house and in collaboration with national and international peers; update curricula to keep up with advancing trend in science and technology, use state-of-the-art best practices in teaching-learning and modern facilities in laboratories and libraries; and provide other supports in aid to students' becoming competent graduates with their potential fully realized and personality well-developed for joining the global forces in making the future of society in a changing world.

Overview of the Department of Pharmacy

Since 1996, UAP is the pioneer in launching 4 years Bachelor of Pharmacy (B. Pharm) program. The Pharmacy Department is one of the most progressive and established departments of the university as well as in the country. Following a bi-semester system, the Bachelor of Pharmacy requires minimum 8 semesters to prepare students as pharmacists and the Master of Science in Pharmaceutical Technology requires minimum 2 semesters to instruct and train the graduate pharmacists for working as integrated members of health-care system. The courses of the B.

Pharm program are offered in 4 Academic sessions consisting of 8 six-monthly semesters. Each academic session consists of 2 semesters and each semester consists of 15 weeks of lectures and lab work, 1 week of preparation period and 3 weeks of Mid-Term and Semester final examination. The Department admits 110 students in the undergraduate and 110 students in the graduate program in a given academic year. From its inception in 1996 with only 6 students enrolled in B. Pharm program it has expanded in 2017 to 110 enrollment. Similarly, only 30 students took admission in MS. Pharm Tech back in 2003 when the masters' program was first introduced but reached a remarkable number of 114 in 2017. Candidates who have an overall GPA of 8.00 in H.S.C and S.S.C are only selected to apply for admission. All of the applicants then have to excel both in a competitive written test and an interview before being selected for admission. Applicants who have a B. Pharm degree from an accredited institution are only selected for MS. Pharm Tech admission. Candidates with a minimum CGPA of 2.75 (scale 4.0) in B. Pharm is required to sit for written admission test.

Vision: The vision of the Department of Pharmacy is to be the preeminent institution in pharmacy education, research and practice where graduates are prepared to lead in pharmaceutical industry, academia and allied sectors at home and abroad.

Mission: The mission of the Department of Pharmacy is

- To develop competent professionals, scientists and academicians by providing the highest quality educational experience
- To foster a learning-centered, research-oriented and professionally motivated educational environment that encourages individuals to make positive contributions to the health sector
- To cultivate relationships with the key stakeholders to meet the changing needs and shape the evolving health care system
- To achieve its mission by striving for excellence in education, service and research, all directed towards enhancing health and quality of life of people

Program Educational Objectives (PEO): Program educational objectives (PEO) are broader statements that describe what students are expected to do in the long run. The final program outcomes are as follows:

- **PEO 1:** To produce pharmacy graduates with strong fundamental concepts and high technical competence in pharmaceutical sciences and technology, who shall be able to use these tools in pharmaceutical industry and/or institutes where ever necessary for success.
- **PEO 2:** To introduce skilled manpower to manage the affairs of hospital pharmacies, pharmaceutical industries, community pharmacy services, drug administration and other

organizations in drug research, marketing, sales and multidisciplinary approach with highly professional and ethical attitude.

- **PEO 3:** To uplift the research on different fields of pharmacy through generating potential knowledge pools so as to develop newer techniques of formulation, quality control and standardization of drugs.
- **PEO 4:** To encourage the students to participate in life-long learning process for a highly productive career and to relate the concepts of Pharmaceutical Sciences towards serving the cause of the society.

Program Outcomes (PO):

PO1: Fundamental and Applied Knowledge
PO2: Technical Expertise
PO3: Problem Identification and Solving Skills
PO4: Communication Skills
PO5: Professionalism and Ethics
PO6: Leadership and Interpersonal Skills
PO7: Patient Care and Medication Management
PO8: Research and Scientific Knowhow
PO9: Entrepreneurship
PO10: Life Long Learning Skills

Skill Mapping

Semester	Course Code	Course Title	Generic Skills/Program Outcomes									
			PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**
FIRST YEAR FIRST SEMESTER	HSS 101	English I- Oral and Written Communication skills	√	√	√							√
	MST 101	Basic Mathematics and Statistics	√	√	√					√		√
	HSS 111	Bangladesh Studies	√	√	√					√		√
	Pharm 105	Introduction to Pharmacy	√	√	√		√		√			√
	Pharm 111	Inroganic Pharmacy-I	√	√	√	√						√
	Pharm 131	Pharmacognosy I	√	√	√	√						√
	Pharm 112	Inorganic Pharmacy Lab	√	√		√						√

	Pharm 132	Pharmacognosy I Lab	√	√	√	√						√
FIRST YEAR SECOND SEMESTER	HSS 103	English II- Language Composition Skills	√	√	√							√
	Pharm 113	Organic Pharmacy	√	√	√	√						√
	Pharm 115	Physical Pharmacy-I	√	√	√					√		√
	Pharm 117	Inorganic Pharmacy-II										√
	Pharm 121	Physiology-I	√		√	√			√	√		√
	Pharm 123	Basic Anatomy	√	√	√				√	√		√
	Pharm 114	Organic Pharmacy Lab	√	√	√	√	√			√		√
	Pharm 116	Physical Pharmacy-I Lab	√	√	√		√					√
SECOND YEAR FIRST SEMESTER	Pharm 215	Physical Pharmacy-II	√	√	√	√				√		√
	Pharm 217	Biochemistry and Cellular Biology	√	√	√					√		√
	Pharm 219	Pharmaceutical Microbiology-I	√	√	√							√
	Pharm 221	Physiology-II	√			√	√	√				√
	Pharm 231	Pharmacognosy-II	√	√	√					√		√
	Pharm 216	Physical Pharmacy-II Lab	√	√	√					√		√
	Pharm 220	Pharmaceutical Microbiology-I Lab	√	√	√				√	√		√
	Pharm 222	Physiology-II Lab	√	√	√	√		√		√		√
	Pharm 232	Pharmacognosy II Lab	√	√	√	√				√		√
SECOND YEAR SECOND SEMESTER	Pharm 229	Pharmaceutical Microbiology-II	√	√	√				√			√
	Pharm 241	Pharmaceutical Technology-I	√	√	√	√				√		√
	Pharm 243	Pharmaceutical Analysis I	√	√	√		√			√		√
	Pharm 251	Basic Pharmaceutics	√	√	√	√			√	√		√
	Pharm 261	Pharmacology-I	√	√	√							√
	Pharm 230	Pharmaceutical Microbiology – II Lab	√	√	√					√		√
	Pharm 242	Pharmaceutical Technology lab I	√	√	√	√		√		√		√
	Pharm 244	Pharmaceutical Analysis-I Lab	√	√	√	√	√	√	√	√		√
	Pharm 262	Pharmacology-I Lab	√	√		√	√	√				√
THIRD YEAR FIRST SEMES	Pharm 305	Pharmaceutical Marketing	√	√	√	√	√					√
	Pharm 333	Medicinal Chemistry-I	√	√	√					√		√
	Pharm 341	Pharmaceutical	√	√	√					√		√

		Technology-II A											
	Pharm 341	Pharmaceutical Technology-II B	√	√	√	√	√						√
	Pharm 353	Biopharmaceutics and Pharmacokinetics-I	√	√	√	√				√			√
	Pharm 361	Pharmacology II	√	√	√		√		√	√			√
	Pharm 371	Pathology	√		√	√			√	√			√
	Pharm 334	Medicinal Chemistry-I Lab	√	√	√				√	√			√
	Pharm 342	Pharmaceutical Technology lab II	√	√	√					√			√
	Pharm 354	Biopharmaceutics and Pharmacokinetics I Lab	√			√	√	√		√			√
THIRD YEAR SECOND SEMESTER	Pharm 307	Pharmaceutical Management	√	√	√		√	√	√		√		√
	Pharm 335	Medicinal Chemistry-II	√	√	√					√			√
	Pharm 343	Pharmaceutical Analysis II and Quality Assurance	√	√	√	√	√			√			√
	Pharm 349	Pharmaceutical Engineering-I	√		√	√		√		√			√
	Pharm 355	Biopharmaceutics and Pharmacokinetics-II	√		√				√	√			√
	Pharm 336	Medicinal Chemistry Lab-II	√	√	√	√	√						√
	Pharm 344	Pharmaceutical Analysis-II lab	√	√	√								√
	Pharm 356	Biopharmaceutics and Pharmacokinetics II Lab	√	√	√								√
FOURTH YEAR FIRST SEMESTER	Pharm 435	Medicinal Chemistry-III	√	√	√					√			√
	Pharm 437	Pharmaceutical Regulatory Affairs	√	√		√	√	√			√		√
	Pharm 441	Pharmaceutical Technology-III	√	√	√	√	√			√			√
	Pharm 447	Advanced Pharmaceutical Analysis	√	√	√		√			√			√
	Pharm 449	Pharmaceutical Engineering-II	√	√	√								√
	Pharm 461	Pharmacology III	√	√	√	√	√		√	√			√
	Pharm 442	Pharmaceutical	√	√	√	√				√			√

		Technology Lab III										
FOURTH YEAR SECOND SEMESTER	Pharm 445	Cosmetology	√	√	√	√	√		√	√		√
	Pharm 453	Pharmaceutical Biotechnology	√	√	√		√		√	√		√
	Pharm 455	Hospital and Community Pharmacy	√				√	√	√			√
	Pharm 457	Pharmaceutical Packaging Technology	√	√			√			√		√
	Pharm 409	Project		√	√					√		√
	Pharm 458	Pharmaceutical Packaging Technology Lab	√	√	√					√		√

Physical Facilities:

Classroom

Department of Pharmacy, located at the 3rd and 4th floor of UAP city campus consistsof an area of 39,000 square foot and it has 6 spacious classrooms equipped with computers, air conditioners and multimedia projectors. Portable sound systems are adjusted on demand to provide the support of audiovisual aid. On an average 50-60 students can be accommodated in each room.

Library

UAP has a central library at the city campus for all of the students. The air conditioned library has capacity to accommodate around 152 readers at a time. The library contains around 19640 books and about 3500 reference and text books for pharmacy which are being regularly updated. For the convenience of the students, the library gives an access to 32 online journals. The Dailynewspapers i.e. Daily Star, Independent, Prothom-Alo, Ittefaq and Daily Observer are placedthere. The library is supervised by seven (7) staffs. Updated library management softwares are available for the library staff for their effective functioning. The library is kept open 7 days a week for theconvenience of the students and faculties.

Computer and internet

Department of Pharmacy has a separate computer lab for students' betterment to prepare assignment, presentation and other documentations that are necessary to prepare. Presently there

are 18 computers in the lab for student's service. But it has enough capacity to accomodate 32 computers in four columns all-around.

Medical and Insurance Facilities

Medical facilities must be adequate, well equipped, accessible and useful to provide emergency healthcare services ensuring health and hygiene within the campus. As per agreement, all UAP members are entiled for 25% discount at Medinova Diagnostic Center. All students of university are covered by the insurance policy with the Green Delta Insurance Ltd.UAP has an allocated medical service center where two certified medical doctors provide primary treatment in case of emergency of students and staffs. Student can avail medical advices free of cost in the designated times. Department of Pharmacy also maintains first aid box facilities.

Laboratory

Pharmacy Department has total 12 laboratories including one computer lab, six undergraduate practical labs, two research labs, two Research and Development analysis and formulation labs (under developing) and one B. Pharm. Project lab for students' practical and thesis purpose. There is a store room for storage and distribution of chemical and equipments as required by different labs throughout the semester. All of the labs are well equipped with modern and sophisticated scientific instruments and maintain proper documentation both for chemicals and log book for instruments. All of the instruments are calibrated, Standard Working Procedures (SOP)s are maintained and followed by students, faculties and lab assistants regularly and accurately.

Teaching Laboratories

- Pharmaceutical Analysis and Physical Pharmacy Lab
- Physiology, Pharmacology and Pharmaceutical Microbiology Lab
- Biopharmaceutics and Pharmacokinetics Lab
- Inorganic, Organic and Medicinal Chemistry Lab
- Pharmaceutical Technology Lab
- Pharmacognosy and Phytochemistry Lab
- B. Pharm Project Lab

- Computer Lab

Research Laboratories

- Biotechnology Research Lab
- Research and Development Formulation Lab
- Research and Development Analysis Lab
- Pharmaceutical Technology Research Lab

Important laboratory machines

- Tablet compression machine
- Capsule filling machine
- PCR
- HPLC
- FTIR
- UV spectrophotometer
- Dissolution machine
- Disintegration machine
- Overhead stirrer
- Rotary evaporator

Co-curricular and Extra-curricular Activities

The Pharmacy department is a regular in organizing and participating in a variety of extra-curricular and co-curricular activities, workshops and seminars beyond the inflexible of the classroom. The various events, sports and recreational programs along with study tours are arranged through different clubs regularly. A number of fully functional clubs are active within the department. These include Pharma Science Society, Pharmacy Debating and Quiz Club, Social Awareness Club, Cultural Club, Sports Club and Photography Club. Programs like blood donations, winter cloth distributions, oral saline supply to flood victims, debating and quiz competitions, cultural programs, cricket and football tournaments, indoor games competitions, photography exhibitions and annual picnic are all executed by these clubs. Aside from the clubs, regular poster presentations, wall magazine display and study tours are organized every year by the department.

Activities performed by different clubs in the Department of Pharmacy

Entry Qualification

In order to ensure entry qualification strictly, entry requirements must be clearly written well communicated to prospective students who are going to be enrolled in that program. Department of Pharmacy has set certain criteria for recruiting prospective students each semester for both B. Pharm and MS. Pharm Tech programs.

A. Admission criteria for B. Pharm (Hons.)

- Candidate must pass HSC/ "A" level or recognized equivalent examination in current year or one previous year.
- Students must have Mathematics, Biology and Chemistry in HSC or equivalent exam.
- Total GPA in SSC and HSC = 8.00

B. **Admission criteria for Master of Science in Pharmaceutical Technology (MS Pharm Tech)**

- Students must complete B. Pharm degree from UGC approved universities/institutions.
- Candidate with a minimum CGPA of 2.75 (scale 4.0) in B. Pharm is required to sit for written admission test.

Admission Procedure

Registrar office of UAP circulates notice for both undergraduate and post graduate admission test which is available on the website of UAP (*http://www.uap-bd.edu*) from where candidates can get the application form for admission into various undergraduate and post graduate programs. Registrar office also advertises in the leading Bengali and English newspapers to inform prospective candidates. Department of Pharmacy conducts admission tests for Spring and Fall Semesters each year. Test dates and time are notified on university website before the admission test.

In Pharmacy program, admission test is carried out by the Admission Test Committee infollowing two phases:Written Test and Viva Voce

a. Admission question type: Multiple Choice Questions (MCQ) on Chemistry (40), Biology (40), and English (20).
b. Candidate with minimum GPA 8.00 (GPA in SSC and HSC) is required to sit for written admission test.

c. Selection of qualified students is done both for graduate and undergraduate as per the following system:

   Total GPA (in SSC and HSC) x 10 + Written test marks.

It is worth mentioning that merit list of candidates are prepared based on marks obtained from total two hundred marks (100 marks from written test and 100 marks from SSC and HSC GPA).

d. A list of selected applicants is published in UAP website and notice board.
e. Selected applicants are required to appear before a viva board.
f. Final selection of the candidate is done based on their viva performance
g. UAP has a waiver policy which is given on the basis of Semester GPA. Tuition fee waiver (only for merit-based) is awarded based on GPA as per the following table.

h. Tuition fee waiver based on GPA

GPA	**Percentage of tuition fee wavier**
3.50 - 3.74	25
3.75 – 3.89	50
3.90 – 3.99	75
4.00	100

i. In addition to the above waiver policy, top 3% students is offered 100%tuition waiver based on semester results. 10% - 100% Vice Chancellor's special tuition fee waiver is offered to poor meritorious students. Moreover, 3% of total seats are reserved for children of Freedom Fighters and will be offered 100% tuition fee waiver. Same percentage of seats and waiver policy is applicable for poor but meritorious students from remote underdeveloped regions of Bangladesh. In case of siblings, 2nd siblings will be awarded 60% tuition fee waiver which is 100% for 3rd siblings.

Rules and regulations

Disciplines in Examinations

Strict discipline is a pre-requisite for the smooth conduct of examination. The following activities by the examinee shall constitute an offence or misconduct. Students are liable to be punished according to UAP rules if they are found to have committed any such offence as mentioned hereunder:

Offences	**Punishment**
1. Any communication between one another.	Warned twice and deduction of 5-15 marks depending on the nature and extent of offence, decided by the invigilator (CI)
2. Appearing at the examination without Admit Cards. 3. Possessing objectionable/illegal/incriminating papers or question paper, materials, electronic gadgets or devices, books, bags, subject related text in any part of body etc. 4. Refusing to hand over/throwing out of reach/swallowing/erasing objectionable/illegal/incriminating papers or question papers, materials, electronic gadgets or devices, books, bags, subject related text in any part of body etc.	Cancellation of the particular examination.
5. Writing on objectionable/illegal/incriminating papers or question paper, materials, electronic gadgets or devices, books, bags, subject related text in any part of body etc. and copying from them. 6. Copying from objectionable/illegal/incriminating papers or question paper, materials, electronic gadgets or devices, books, bags, subject related text in any part of body etc. clothes, handwritten/printed/cell phone or photocopied materials etc.	Cancellation of the concerned semester/decided by UAP exam board with the consent of CI.
7. Writing anything on the wall, desk, bench, clothes, blackboard, floor or in any part of the body and copying from these writings. 8. Changing or exchanging registration number/Answer Script/ question paper between examinees. 9. Intimidating, abusing, taunting or misbehaving with the Invigilators on duty or anybody concerned with the conduct of examination. 10. Impeding/creating obstruction or disturbance in smooth holding / conducting of examination, or preventing others to take the examination or provocation examinees to leave the examination hall.	Cancellation of the concerned semester as a whole.

11. Assaulting or any such attempts to assault invigilators or any person concerned with the examinations in or outside the examination hall/premises. 12. Trying to smuggle in or out any Answer/Question papers or adding such smuggled Answer Script / sheet with the original Answer Script. 13. Having handwriting of two different persons in the same Answer Script. 14. Taking a seat illegally in an unauthorized place in lieu of his/her marked seat/room and refusing to move to his/her authorized place or room.	
15. Changing /substituting a cover or inside page of the Answer Script of the university. 16. Writing something objectionable and/or irrelevant things in the Answer Script to the invigilator.	Expulsion for two semester immediately including the present one.
17. Leaving the examination hall without submitting the Answer Script to the invigilator. 18. Damaging /tearing off the Answer Script/objectionable papers/cell phone or any other electronic device etc. or refusing or creating any obstruction to hand over such papers/cell phone any other electronic device to the authority. 19. Appearing in the examination through impersonation.	Expulsion for two consecutive semesters.
20. Trying to avail special advantage illegally by fascination/pretexts of any sort (fake medical certificate/false incident/fake documents or any other fraudulent activities).	Cancellation of the ongoing semester.
21. Damaging furniture/gadgets/equipments/vehicle or any other property of university/ or anyone in the examination hall/premises or trying to set fire on such valuables in the examination hall/premises. 22. Such other acts not mentioned above on the part of examinee as in the opinion of the authority may be regarded as an offence. Disciplinary action in the form of cancellation of the examination and debarring from appearing at the subsequent examinations may be taken by the appropriate authority/ discipline committee of the University.	Appropriate financial realization for the damages made and permanent expulsion from the University.

Code of Conduct

The UAP is very keen to keep its campus free from any sort of sexual abuse or harassment. To attain this goal, the UAP administration needs the cooperation and commitment of all: the

students, the faculty and the stuff, alike. Sexual abuse and harassment have been identified as below:

1. Behavior colored with unwelcome sex appeal (direct or by indication) like physical touch or advances.
2. Attempts or efforts to establish sexual relation by abuse or administrative/ professional power.
3. Language with tinge of sexual abuse and harassment.
4. Demand or request for sexual favors.
5. Showing pornography.
6. Remark or gesture implicating sex appeal.
7. Teasing through indecent gesture, language or remark, to get near to or follow someone with the aim of fulfilling filthy intensions without one's knowing and to tease or cut jokes in language implicating sex.
8. To say or write anything on letter, telephone, cell phone, SMS, photo, notice, cartoon, bench, chair, table, notice board, office, factory, laboratory, classroom, walls of bathrooms/toilets with a motive of sex implications.
9. Taking still or video photographs for the purpose of blackmailing and character assassination.
10. To pose threat to keep someone away from participation in sports, cultural, institutional and academic activities for fear of sexual abuse and harassment.
11. To pose threat or exert pressure in case of refusal of love proposals.
12. To establish or try to establish sexual relation by intimidation, deception or false assurance.

Anyone, male or female, having any complaint against anybody on any of the above grounds, must contact the 'Departmental Focal Point' (there is one in each department) of the 'Complaint Committee' and act on his/her advice. The administration is determined to take appropriate actions against the violators. UAP has a Sexual Harassment Committee headed by Dr. Swarnali Islam Khandaker, Professor, Department of Pharmacy.

Class Attendances

Students are required to attend all lectures, tutorials, and lab works of the courses that they have registered. Required percentage of attendance (70%) is mandatory for a student to be eligible to sit in the semester final examination.

Teaching assessment strategy

Following strategies are usually applied in different courses:

Teaching Assessment	Assessment Method	(%)
Assessment	Quiz and/ or presentation and/ or group discussion and/ or assignments and/ or viva voice	20
Midterm Exam	Written Exam	30
Final Exam	Written Exam	50

Policies for course repeat /Improvement

For an 'F' grade, the course must be repeated in the next consecutive semesters. As for the improvement of any grade (up to 'A-' grade), the incumbent student may be allowed to repeat only one time for a particular course.

Eligibility for Semester Final Examination

- No student shall be eligible to take part in any semester final examination unless:
- S/he is officially registered for particular course(s)
- S/he has fulfilled the required percentage (70% and above) of class attendance and other requirements
- S/he has fulfilled the required payments of fees and charges etc.

Policy for Repeat Exam

- If any student cannot appear at semester final examination on medical grounds or unavoidable circumstances and concurrently two registered course exams at a same time acceptable to the concerned authority, s/he is permitted to sit for the repeat examination for the missing course(s).
- An application should be submitted to the Controller of Examinations on due date mentioned in academic calendar through the Head of the department with the supporting documents.

- Supporting documents (medical certificates) should be verified by the UAP registered doctors.
- If the application is approved then an "I" (incomplete) grade will be given in the semester final result by the Examination Division.
- For repeat final examination, students have to pay Tk. 3,000/- per course.

Research Activities

Pharmaceutics and Pharmaceutical Technology Research

Pharmaceutics and Pharmaceutical Technology Research Group is conducting the study of different validation methods, different drug delivery systems (like microsphere, pellets, biodegradable implants, self emulsifying drug delivery system-SEDDS, solid dispersion-SD, bilayer drug delivery system, liposomes and noisome drug delivery system), different dosage form like tablet, minitablet, bilayer tablet, compressible capsule etc., drug formulation, basic quality evaluations of raw, intermediate and finished products, drug delivery, drug release kinetics, protein binding of drugs, mixture design of dosage form and observation of polymeric interaction, crystallization and nano-crystallization, dissolution and solubility enhancement of poorly soluble drugs by solid dispersion and using hydrophilic carrier, Biphasic oral solid drug delivery, Liquisolid technique, Self-emulsifying drug delivery and controlled release dosage form technology.

Pharmacology and Biotechnology Research

Biotechnology research lab is one of the most sophisticated labs in the Department of Pharmacy where plasmid DNA isolation, protein synthesis, PCR technology and polymorphism of different genes and other biotechnology related research works are performed.

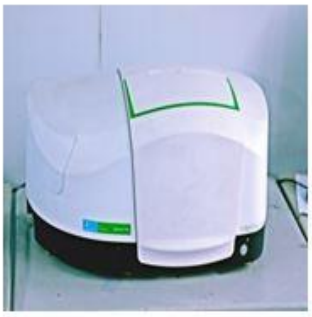
Phytochemistry and Natural Products Research

This group works to explore the potential of medicinal plants of folklore medicinal uses. Isolation of bioactive molecule, evaluation of analgesic and anti-inflammatory, anthelmintic, antibacterial and antifungal, anticancer, antidiabetic, antidiarrhoeal, diuretic, hepatoprotective, and thrombolytic activity among others. Quantitative analysis of antioxidative components like

total amount of phenolics, flavonoids and flavonols are estimated using spectrophotometric method.

Microbiology Research

In the microbiology lab, isolation and purification of causative agents of different diseases and determination of resistance pattern of different microorganisms against antibiotics are performed.



FTIR

Dissolution tester

Rotary Evaporator

Incubator

Sonicator

Friabilator

HPLC

Distillation plant

PCR

Curriculum Design

Curriculum of the Department of Pharmacy has been prepared by the faculty members under the Curriculum Committee through suggestions and feedback of faculty members, professionals and experts in relevant fields. Primarily 100-400 Level courses are offered for Bachelor of Pharmacy students and 500 Level courses are offered to the Master of Science in Pharmaceutical Technology Course. First digit of the course code indicates the year in which the course is offered and the other two digits are for course number. The courses are as follows:

Courses of Bachelor of Pharmacy:

FIRST YEAR, FIRST SEMESTER			
Course Code	**Course Title**	**Course Type**	**Credits**
HSS 101	English I - Oral and written communication Skills	G	3
MST 101	Basic Mathematics and Statistics	G	3
Pharm 105	Introduction to Pharmacy	F	3
HSS 111	Bangladesh Studies: A. Society and Culture	G	2
	B. Bangladesh History	G	2
Pharm 111	Inorganic pharmacy-I	F	3
Pharm 112	Inorganic pharmacy Lab	F	1
Pharm 131	Pharmacognosy-I	C	3
Pharm 132	Pharmacognosy-I Lab	C	1
ORE 101	Oral Examination (Semester-1)		1
	Total Credit		**22**

	FIRST YEAR, SECOND SEMESTER		
HSS 103	English II - Language Composition Skills	G	3
Pharm 113	Organic Pharmacy	F	3
Pharm 114	Organic Pharmacy Lab	F	1
Pharm 115	Physical Pharmacy-I	F	3
Pharm 116	Physical Pharmacy-I Lab	F	1
Pharm 117	Inorganic Pharmacy-II	F	3
Pharm 121	Physiology-I	F	3
Pharm 123	Basic Anatomy	F	3
ORE 102	Oral Examination (Semester-2)		1
	Total Credit		**21**

	SECOND YEAR, FIRST SEMESTER

Pharm 215	Physical Pharmacy-II	F	3
Pharm 216	Physical Pharmacy-II Lab	F	1
Pharm 217	Biochemistry and Cellular biology	F	3
Pharm 219	Pharmaceutical Microbiology-I	F	3
Pharm 220	Pharmaceutical Microbiology-I Lab	F	1
Pharm 221	Physiology-II	F	3
Pharm 222	Physiology Lab	F	1
Pharm 231	Pharmacognosy-II	C	3
Pharm 232	Pharmacognosy-II Lab	C	1
ORE 201	Oral Examination (Semester-3)		1
	Total Credit		**20**

	SECOND YEAR, SECOND SEMESTER		
Pharm 229	Pharmaceutical Microbiology-II	F	3
Pharm 230	Pharmaceutical Microbiology-II Lab	F	1
Pharm 241	Pharmaceutical Technology-I	C	3
Pharm 242	Pharmaceutical Technology-I Lab	C	1
Pharm 243	Pharmaceutical Analysis-I	C	3
Pharm 244	Pharmaceutical Analysis-I Lab	C	1
Pharm 251	Basic Pharmaceutics	C	3
Pharm 261	Pharmacology-I	C	3
Pharm 262	Pharmacology-I Lab	C	1
ORE 202	Oral Examination (Semester-4)		1
	Total Credit		**20**

	THIRD YEAR, FIRST SEMESTER		
Pharm305	Pharmaceutical Marketing	C	3
Pharm 333	Medicinal Chemistry-I	C	3
Pharm 334	Medicinal Chemistry-I Lab	C	1
Pharm 341	Pharmaceutical Technology-II	C	3
Pharm 342	Pharmaceutical Technology-II Lab	C	1
Pharm 353	Biopharmaceutics and Pharmacokinetics-I	C	3
Pharm 354	Biopharmaceutics and Pharmacokinetics-I Lab	C	1
Pharm 361	Pharmacology-II	C	3
Pharm 371	Pathology	C	3
ORE 301	Oral Examination (Semester-5)		1

	Total Credit		**22**
	THIRD YEAR, SECOND SEMESTER		
Pharm 307	Pharmaceutical Management	G	3
Pharm 335	Medicinal Chemistry-II	C	3
Pharm 336	Medicinal Chemistry-II Lab	C	1
Pharm 343	Pharmaceutical Analysis-II and Quality Assurance	C	3
Pharm 344	Pharmaceutical Analysis-II and Quality Assurance Lab	C	1
Pharm 349	Pharmaceutical Engineering-I	C	3
Pharm 355	Biopharmaceutics and Pharmacokinetics-II	C	3
Pharm 356	Biopharmaceutics and Pharmacokinetics-II Lab	C	1
ORE 302	Oral Examination (Semester-6)		1
	Total Credit		**19**
	FOURTH YEAR, FIRST SEMESTER		
Pharm 435	Medicinal Chemistry -III	C	3
Pharm 437	Pharmaceutical Regulatory Affairs	C	3
Pharm 441	Pharmaceutical Technology-III	C	3
Pharm 442	Pharmaceutical Technology-III Lab	C	1
Pharm 447	Advanced Pharmaceutical Analysis	C	3
Pharm 449	Pharmaceutical Engineering-II	C	3
Pharm 461	Pharmacology-III	C	3
ORE 401	Oral Examination (Semester-7)		1
	Total Credit		**20**
	FOURTH YEAR, SECOND SEMESTER		
Pharm 445	Cosmetology	G	3
Pharm 446	Cosmetology-Lab	G	1
Pharm 453	Pharmaceutical Biotechnology	C	3
Pharm 455	Hospital and Community Pharmacy	C	3
Pharm 457	Pharmaceutical Packaging Technology	C	3
Pharm 458	Pharmaceutical Packaging Technology-Lab	C	1
Pharm 409	Thesis or Project	C	3
Pharm 407	Practical Training	C	0
ORE 402	Oral Examination (Semester -8)		1
	Total Credit		**18**

Total Bachelor of Pharmacy Credits	162

Here, C: Core Course, F: Foundation Course, and G: General Course

Courses of Master of Science in Pharmaceutical Technology (Non-Thesis and Thesis):

	FIRST SEMESTER			
Course Code	**Course Title**	**Course Type**	**Credits**	
			Non-Thesis	**Thesis**
Pharm 541	Advance Pharmaceutical Technology	C	4	4
Pharm 543	Modern Drug Delivery Systems	C	4	4
Pharm 553	Biopharmaceutics and Pharmacokinetics	C	4	4
	SECOND SEMESTER			
Pharm 545	Pharmaceutical Manufacturing Management	C	2	
Pharm 547	Advance Pharmaceutical Engineering	C	2	
Pharm 506	Project	C	6	
Pharm 508	Thesis Paper	C		12
Pharm 500	Thesis Presentation	C		4
Pharm 600	Viva	C	2	2
	Total Credits		**24**	**30**

Course Contents:

FIRST YEAR, FIRST SEMESTER

HSS 101 English-I: Oral and Written Communication Skill Credit 3

Oral and written communication skills include communicative expressions for day-to-day activities, both for personal and professional requirement. Grammar items will mainly emphasize the use of articles, numbers, tense, right form of verbs, pronouns, punctuations etc. Sentence formation, question formation, transformation of sentence, simple passive voice construction, and conditionals will also be covered.

Recommended books:

1. Reading and Writing Skills - Raihan Shams and Ms. Hoque
2. Technical writing and professional communication - Thomas N. Hacking, Leslie. A. Oslen
3. Academic writing course - Jordon. R.R. (London: Collins ELT).

4. Bockever, Keith and Brown, Charles P. Oxford: Oxford University press.
5. Oxford- Advanced Learner's Dictionary.
6. The Cambridge English course 1 and 2 - Micael Swan and Catherine Walter (Cambridge University press.)

MST 101 Basic Mathematics and Statistics Credit 3

Section A: Mathematics:

Calculus: (a) Rate of process, rules of differentiation, successive and partial differentiation, differentiation of a function, relation between the derivatives of inverse function. (b) Rules of integration- integration as a summation, area under a curve, integration by partial fraction, graphical integration.

Section B: Statistics:

1. **Graphical and diagrammatic representation**- Graphs and diagrams.
2. **Measurement of central tendency** – Arithmetic mean, geometric mean, harmonic mean, median and mode.
3. **Measures of dispersion** – Range of mean deviation, variance, coefficient of variance, standard deviation.
4. **Moments, Skewness and kurtosis.**
5. **The correlation of measurement** – General notion of correlation, calculation of correlation coefficient.
6. **Regression analysis** – Basic idea of regression, calculation of regression coefficient, standard error and significance test.
7. **Probability distribution** – The normal, binominal and Poisson distribution, derivation, means and variances.
8. **The basic ideas of significance test** – Simple significance tests based on the normal distribution, comparison with a known standard, comparison of means of two large samples. The use of 't' test for small samples, importance of small sample comparison of sample mean with a standard, comparison of means of two small sample (unknown variances- assumed equal, not assumed equal) confidence limits.

   X^2 –tests of goodness of fit and homogeneity introduction to general idea, testing the fit of a whole frequency distribution to data, tests of homogeneity, variance ratio test.

9. **Simple experimental design and the analysis of variances** – Introduction, completely randomized design, randomized block design, testing the homogeneity of variances.
10. **Introduction to factorial experiments** – Principle basic ideas, notation in 2n factorial, scope of more advanced designs.
11. **Random samples and random numbers**- The need and use, representative samples.

Recommended books:

1. Medical and Pharmaceutical Statistics- Hannan, JMA
2. Pharmaceutical Statistics- Sanfurol Bolton Charles

3. Differential Calculus - Das and Mukharjee.
4. Integral Calculus - Das and Mukharjee.

HSS 111 Bangladesh Studies Credit 4

Part-I: Society and Culture

The sociology perspective, primary concepts, factors of social life, social structures and process, social institutions, culture and civilization, city and country, social changes, problems of society, social problems of Bangladesh, urbanization process and its impact on Bangladesh society will be covered.

Part-II: Bangladesh History

The land, the geographical factor, and the people of Bangladesh. Historical perspectives: Ancient Bengal, early medieval Bengal, late medieval Bengal, beginning of British rule in Bengal, nineteenth century Bengali renaissance and area of social and religious reforms, partition of Bengal and its annulment, Bengal politics in the 1930's and 1940's, elections of 1936-37, Pakistan movement, partition of Bengal (1947), language movement (1952), movement of autonomy, 6-point and 11-point programs, the 1970 election, genocide in East Pakistan, The Liberation War, the emergence of Bangladesh as a sovereign independent state in 1971.

Recommended books:

1. Social and cultural history of Bengal, vol. 1 and 2 - M. A. Rahim.
2. Democracy and Development in Bangladesh - Moudud Ahmed.
3. National cultural and heritage of Bangladesh - A. F. M. Salauddin Ahmed and Bazlul Mobin Chowdhury.
4. Society, politics and economics of Bangladesh - S. R. Chakraborty (ed).

Pharm 105 Introduction to Pharmacy Credit 3

1. **The History and Evolution of Pharmacy**: The drug-taking animal, prehistoric Pharmacy, Antiquity, The Middle Ages, The Renaissance and Early Modern Europe, The Era of Count and Pour, The emergence of Clinical Pharmacy, A Chronology for Pharmacists
2. **Complementary and alternative medicine:** Ayurvedic, Unani, Homoeopathic and other systems of medicines.
3. **Definition of drugs, sources and classification of drugs, official, non-official and unofficial drugs**. Basic introduction on different types of dosage forms, routes of drug administration, fate of drug after administration.

4. **An introduction to pharmacy and pharmacy education**: Definition of pharmacy, subjects taught in pharmacy etc.
5. **Pharmacy profession and ethics**. Scope of pharmacy profession in different areas, such as, community, industry, government, etc. Ethics of pharmacy.
6. **Information resources for pharmaceutical science**: Sources of drug information, the pharmacopoeias, codex etc. Internet resources on pharmaceutical and drug information.

Recommended Books:

1. The Science and Practice ofPharmacy - Remington
2. Introduction to Pharmacy - Shah Md. Amran.

Pharm 111 Inorganic Pharmacy-I Credit 3

1. **Structure of atoms**: An elementary treatment of theories of atomic structure, different atomic models with their postulations and limitations, quantum numbers and their significance, Pauli's exclusion principle, origin of spectral lines, band and line spectrum.
2. **Chemical bonds**: Electronic concept of valence, different types of chemical bond e.g. ionic, covalent, co-ordinate covalent, metallic, van der Waals force, hydrogen bond, properties of different types of chemically bonded compounds and their comparisons, theories of covalent bonding and hybridization.
3. **Classification of elements**: Modern periodic table and periodic law, usefulness and limitations of periodic table, variation of properties within periods and groups, shielding effect and effective nuclear charge, s, p, d and f block elements.
4. **Chemistry of alkali and alkaline earth metals**: General characteristics of alkali and alkaline earth metals, chemistry of group IA and II elements and their compounds, comparison of alkaline earth metals with alkali metals, physiological importance and pharmaceutical applications of alkali and alkaline earth metals.
5. **Chemistry of co-ordination compounds**: Ligands or coordinating groups, monodentate or unidentate ligands, polydentate ligands, co-ordination number, co-ordination sphere, chelation, factors affecting the stability of metal complexes, application of chelate formation, isomerism of co-ordination compounds, Warner's co-ordination theory, Sidgwick's electronic concept of co-ordinate bond in co-ordination compounds, valence bond theory, pharmaceutical importance of chelation.
6. **Chemical Impurities**: The occurrence of impurities in medicinal chemicals and substances used in pharmaceuticals. Determination of impurities in pharmaceuticals.

Recommended books:

1. Modern Inorganic Chemistry- R. D.Madan,
2. Inorganic Medicinal and Pharmaceutical Chemistry- Block, John H., Roche, Edward B., Soine, Taito O, Wilson, Charles O, Lea and Febiger, Philadelphia.
3. Text book of pharmaceutical chemistry – I and II - Mohammad Ali
4. Introduction to Modern Inorganic Chemistry- S. Z. Haider.

5. Introduction to Modern Inorganic Chemistry- J. D Lee.
6. Bentley and Driver's Textbook of Pharmaceutical Chemistry- Bently.
7. Modern Inorganic Pharmaceutical Chemistry- Clarence A. Discher, Leonard C. Bailey, Thomas Medwick.
8. Rogers Inorganic Pharmaceutical Chemistry- Rogers, Charles Herbert, Taito O. Some and Charles O. Wilson, Philadelphia, Lea and Febiger.

Pharm 112 Inorganic Pharmacy-I Lab Credit 1

Qualitative analysis of Inorganic compounds.

Pharm 131 Pharmacognosy-I Credit 3

1. **Definition and scope of Pharmacognosy**, its historical development.
2. **Structures of the plant cell as a unit, its function and form**; Introduction to the general structure of the morphological parts of the plants.
3. **Crude drugs**: A general view of their origin, distribution, cultivation, collection, drying and storage, commerce and quality control.; classification of drugs; preparation of drugs for commercial market; evaluation of crude drugs; drug adulteration.
4. **Plant analysis**: Extraction, separation, chromatography; types of plant constituents, comparative phytochemistry and chemotoxicity.
5. **Phytochemistry and pharmaceutical uses of the following plant constituents along with consideration of some important drugs of each group**:
   A) **Lipids**: castor oil, linseed oil, coconut oil, olive oil, peanut oil, chaulmoogra oil and beeswax.
   B) **Carbohydrate and related compounds**: sugars and sugar containing drugs- sucrose, dextrose, glucose, fructose.
   C) **Polysaccharide containing drugs**- starches, dextrins etc.
   D) **Gums and mucilages**- tragacanth, acacia, sterculia, sodium alginate, agar cellulose.
6. **Plants in complimentary and traditional systems of medicine**: Introduction, different types of alternative systems of treatments (eg. ayurvedic, unani, homeopathic medicine.), contribution of traditional drugs to modern medicines. Details of some common indigenous traditional drugs: punarnava, vashaka, anantamul, arjuna, chirata, picrorhiga, kalomegh, amla, asoka, bahera, haritaki, tulsi, neem, betel nut, joan, karela, shajna, carrot, bael, garlic, jam and madar.
7. **Vitamins and vitamin containing animal drugs**: Cod liver oil, shark liver oil, hilsha fish/liver oil etc.

Recommended Books:

1. Pharmacognosy- Varro E. Tyler, Lynn R, Brady and James E, Robbers, Lea and Febiger, Philadelphia.
2. Pharmacognosy- Trease and Evans.
3. Pharmacognosy- Edward P. Claus, Varro E.Tyler, Lea and Febiger, Philadelphia.
4. Textbook of Pharmacognosy- T. E. Wallis, J and A Churchill.
5. Practical Pharmacognosy- Rasheeduz Zafar, CBS Publishers.
6. Natural Products, A Laboratory Guide - Raphael Ikan, Acadec Press, Inc., London.

Pharm 132 Pharmacognosy-I Lab Credit 1

Study of some medicinal plants of Bangladesh

ORE 101 **Oral Examination (Semester-1) Credit 1**

FIRST YEAR, SECOND SEMESTER

HSS 103 English-II : Language Composition Skills Credit 3

Writing skills include sentence construction, grammar review, paragraph writing and writing essay from paragraph. Specific applications include writing formal letter, resume/CV, report, memo etc. Reading skills include reading for main ideas, using contexts for vocabulary, scanning for details, making inferences. Oral presentations cover oral reports, interviews and communication over telephone.

Recommended Books:

1. Reading and Writing Skills - Raihan Shams and Ms. Hoque
2. Technical writing and professional communication - Thomas N. Hacking, Leslie. A. Oslen
3. Academic writing course - Jordon. R.R. (London: Collins ELT).
4. Bockever, Keith and Brown, Charles P. Oxford: Oxford University press.
5. Oxford- Advanced Learner's Dictionary.
6. The Cambridge English course 1 and 2 - Micael Swan and Catherine Walter (Cambridge University press, with cassettes.)

Pharm 113 Organic Pharmacy Credit 3

1. **Introduction**: History of organic chemistry, classification of organic compounds, systematic naming of organic compounds, electro negativity, polarity of bonds, polarity of molecules, structures and physical properties, intermolecular forces, carbonium ions, carbanion ions, electrophiles, nucleophiles, free radicals, hydrogen bonding, melting point, boiling point,

solubility, isomerism.

2. **Chemistry of aliphatic compounds**
   a) **Alkanes, alkenes and alkynes**: Properties, nomenclature, preparations, identifications, reactions and pharmaceutical applications of alkanes, alkenes and alkynes.
   b) **Aldehydes and ketones**: Properties, nomenclature, preparations, identifications, reactions and pharmaceutical applications.
   c) **Alcohols, ethers and epoxides**: Properties, nomenclature, preparations, identifications, reactions and pharmaceutical applications.
   d) **Carboxylic acids**: Properties, nomenclature, preparations, identifications, reactions and pharmaceutical applications.
   e) **Amines**: Properties, nomenclature, preparations, identifications, reactions and pharmaceutical applications.
3. **Chemistry of aromatic compounds**: Aromaticity, general chemistry of aromatic compounds, with special reference to biological and pharmaceutical importance.
   a. Simple aromatic compounds,
   b. Aromatic halogen compounds
   c. Aromatic nitro compounds
   d. Aromatic amino compounds
   e. Diazonium salts and their related compounds
   f. Phenols
   g. Aromatic acids
4. **Heterocyclic compounds**: Pyrrole, pyridine, indole, quinoline

Recommended Books:

1. Organic Chemistry- Robert Thornton Morrison and Robert Neilson Boyd, Prentice- Hall of India, Private Ltd.
2. A Textbook of Organic Chemistry- Arun Bahl and B. S. Bahl, S. Chand and Company Ltd.
3. Organic Chemistry, vol. I and II- L. Finar, Long man, London.
4. Organic Chemistry- Louis Felser and Mary Feiser, Asia Publishing House, India.
5. Advanced Organic Chemistry- B. S. Bahl and Arub Bahl, S. Chand and Company Ltd.
6. Introduction to Organic Laboratory Techniques- Donald L, Pavia, Gary M. Lampman, George S. Kriz, Randall G. Engel, Thomson Brooks Cole.
7. Advanced Organic Chemistry- Reactions, Mechanisms and Structure, Jerry March, John Willey and Sons.
8. A Text Book of Organic Chemistry- Raj K. Barisal, New Age International (P) Limited.

Pharm 114 Organic Pharmacy Lab Credit 1

1. Qualitative analysis of organic samples: Identification of functional groups
2. Identification of dosage forms by color changes

Pharm 115 Physical Pharmacy-I Credit 3

1. **Chemical equilibrium:** Law of mass action, determination of equilibrium constant, heterogenous equilibrium and homogenous equilibrium, the Le Chartelier principle, Van't Hoff equation.
2. **Chemical thermodynamics:** Introduction, the first law of thermodynamics, work, energy and heat, work of expansion, internal energy, determination of internal energy, heat change at constant volume and constant pressure, thermodynamic reversibility, work of isothermal reversible expansion of gases, the maximum work under the isothermal expansion of a gas, heat capacities, difference between molar heats, Adiabatic processes, Joule-Thomson experiment.
3. **Thermochemistry and thermochemical law:** Second law of thermodynamics, Carnot's cycle and efficiency of a perfect engine, the concept of entropy and entropy changes for an ideal gas expansion, entropy changes of materials under various conditions, free energy and work functions, Gibbs Helmholtz equation, free energy changes under equilibrium, the Clausius-Claperon equation.
4. **Phase equilibria:** Phase, components and degree of freedom, the phase rules and its thermodynamic deviation, the phase diagrams of water and sulphur systems, partially miscible liquid pairs: the phenol and water, nicotine water system; Completely miscible liquid pairs and their separation by fractional distillation; freeze drying (lyophilization).
5. **Solution:** Types and properties of solution; units of concentration; ideal and real solution; Henry's law; distribution of solids between two immiscible liquids; distribution law; partition coefficient; solvent extraction.
6. **Solution of electrolytes:**Concentration expressions, equivalent weights, colligative properties of dilute solution, osmotic pressure, measurement of osmotic pressure, Van't Hoff and Morse equations for osmotic pressure, coefficients for expressing colligative properties
7. **Ionic equilibria:** Modern theories of acids, bases and salts, acid-base equilibria, Sorensen's pH scale, species concentration as s function of pH, calculation of pH, acidity constants,
8. **Buffer and isotonic solutions:** Buffer equations, buffer capacity, buffer in pharmaceutic and biologic systems, buffered isotonic solutions, methods of adjusting tonicity and pH.

Recommended Books:

1. Principle of Physical Chemistry- M. Mahbubul Haque and M. Ali Nawab, Student Publication.
2. Physical Pharmacy- Alfred N. Martin, Pilar Bustamonte, Lippincott Williams and Wilkins.
3. Elements of Physical Chemistry- Macmillan
4. Physical Chemistry- P. W. Atkins, Peter Atkins, Julio De Paula, W. H Freeman and Company.
5. Essentials of Physical Chemistry- B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand and Company Ltd.
6. Quantitative analysis- V. Alexeyev, CBS Publishers.

Pharm 116 Physical Pharmacy-I Lab Credit 1

1. Preparation of solutions of different pH.
2. Preparation of buffer
3. Standardization of acids and bases
4. Determination of pK_a and pK_b values.
5. Determination of phase diagram of binary systems.
6. Determination of heat of solution of different salts by water calorimetry.
7. Determination of titration curves of acids and bases
8. Determination of molecular weight of substances by Victor Meyer's method.
9. Determination of distribution coefficients of oxalic acid between ether and water.
10. Experiment on Dialysis.

Pharm 117 Inorganic Pharmacy-II Credit 3

1. **Inorganic Medicinal Agents**:
   a) Gastrointestinal Agents: Antacids (Aluminium, Magnesium preparations with application) and adsorbents, saline cathartics, their preparations with applications.
   b) Agents for bone and bone growth: Calcium preparations.
   c) Haematinic Agents: Iron and iron preparations.
   d) Dental Preparations: Fluorides and other anti-caries agents,
   e) Topical Agents: Zinc oxide, iodine preparations, and other anti-microbial, astringents and protective.
2. **Major Intra and Extra-cellular Electrolytes**: Major physiological ions, electrolytes used for replacement therapy, electrolytes used in acid-base therapy, electrolytes combination therapy etc.
3. **Essential trace elements for nutrition and growth and their functions**: Copper, cadmium, zinc, molybdenum, selenium, silicone etc. and their preparations.
4. **Radioactivity and radiopharmaceuticals**: Introduction, types of radiation and their properties, radioactive decay, half-life, average life, modes of radioactive decay, interaction of radiation with matter, measurement of radioactivity, radiation hazard and radiological safety, biological effects of radiation, control of radiation exposure, storage of radioactive materials, medical applications of radionuclides, official radioactive compounds and their importance, toxicity of radioactive isotopes.

Recommended books:

1. Modern Inorganic Chemistry- R. D.Madan,
2. Inorganic Medicinal and Pharmaceutical Chemistry- Block, John H., Roche, Edward B, Soine, Taito O, Wilson, Charles O, Lea and Febiger, Philadelphia.
3. Text book of pharmaceutical chemistry – I and II - Mohammad Ali
4. Introduction to Modern Inorganic Chemistry- S. Z. Haider.
5. Introduction to Modern Inorganic Chemistry- J. D Lee.
6. Bentley and Driver's Textbook of Pharmaceutical Chemistry- Bently.

7. Modern Inorganic Pharmaceutical Chemistry- Clarence A. Discher, Leonard C. Bailey, Thomas Medwick.
8. Rogers Inorganic Pharmaceutical Chemistry- Rogers, Charles Herbert, Taito O. Some and Charles O. Wilson, Philadelphia, Lea and Febiger.

Pharm 121 Physiology-I Credit 3

1. **General Physiology**: Physiology and its scope in pharmacy. Structure of cell, its various organelles and functions, cell division, body fluid compartments and its composition, transport across cell membrane and membrane potentials, homeostasis.
2. **Blood system**: Composition and functions of blood. Plasma and its components, plasma proteins and their functions. Blood coagulation, blood transfusion and blood groups, hemolysis, ESR. Blood forming cells: characteristics, functions, their formation and destruction. Hemoglobin: its structure, properties, function and hemoglobin derivatives. Anemia-: definition and classification, causes and clinical features of various anemia.
3. **Cardiovascular system**: Heart: structure and blood circulation, cardiac muscle, their properties, origin of heart beat and action potential, cardiac cycle, heart sounds, cardiac output, ECG, regulation of cardiac function. Blood pressure: types, significance, measurement and regulation. Hypertension: types and causes.
4. **Digestive system**: Structure of different parts of alimentary system, gastrointestinal motility and its control, swallowing and defecation. Secretion of digestive juices from saliva, gastric, pancreatic, intestinal glands and bile. Functions of digestive juices and their mechanism and regulation of secretions. Digestion and absorption of various foodstuffs. Liver: function, formation of bile and its circulation.
5. **Respiratory system**: Organs of respiratory system and its structure, inspiration and expiration, mechanism of respiration, pulmonary ventilation, ventilation volumes. Gaseous exchange through lungs, carriage of O_2 and CO_2. Hypoxia- causes and classification.

Recommended books:

1. Human Physiology (Vol. I and II)- Chandi Charan Chatterjee, Medical Allied Agency, Calcutta.
2. A Text Book of Medical Physiology- Arther C. Guyton, W. B. Sander's Company, Appleton and Lange
3. Review of Medical Physiology- W. F. Ganong, Medical Publication.
4. A Text Book of Practical Physiology- C.L. Ghai, South Asia Books.
5. Gray's Anatomy- Spalding Gray, (International students edition), published by Churchill Livingstone.

Pharm 123 Basic Anatomy Credit 3

1. **Cell and Tissue**: Structure and function of cells. Definition, classification, characteristics, distribution, minute structures and functions of different tissue. Bone and cartilage.
2. **Alimentary system**: Oral cavity, pharynx, esophagus, stomach, small intestine, caecum, appendix, colon, sigmoid, rectum, anal canal.
3. **Cardiovascular system**: Heart, ascending aorta, arch of the aorta, descending thoracic aorta, abdominal aorta.
4. **Respiratory system**: Nose, pharynx, larynx, trachea, bronchus, lung.
5. **Urinary system**: Kidney, ureter, urinary bladder, urethra
6. **Reproductive system**: Female-ovary, uterus with fallopian tube, cervix, vagina; Male: Testis, ductus diferens, seminal vesicle, prostate, urethra. External genitalia: male- scrotum, penis. Female: Labium majora, L.minora, clitories vaginal orifice.
7. **Nervous system** : CNS: Brain and spinal cord; PNS: spinal nerve and autonomic nervous system (sympathetic and parasympathetic)
8. **Sensory organs**: Eye, ear, skin (histological characteristics of epidermis, dermis, hypodermis etc.)
9. **Endocrine gland**: Pituitary gland, thyroid and parathyroid gland, pancreas, adrenal gland, ovary, testis.
10. **Exocrine gland**: Parotid gland, submandibular gland, pancreas.
11. **Metabolic organ**: Liver with gall bladder.
12. **Reticulo endothelial system**: spleen, thymus, tonsil, lymph node, bone marrow.

Recommended books:

1. Gray's Anatomy- Spalding Gray, (International students edition), published by Churchill Livingstone.
2. Human Anatomy: Regional and applied Dissection and Clinical – Vol. 1, 2 and 3- Chaurasia, B. D.
3. Essentials of Anatomy and Physiology- Seeley, Rod R.

ORE 102

Pharm 102 Oral Examination (Semester- 2) Credit 1

SECOND YEAR, FIRST SEMESTER

Pharm 215 Physical Pharmacy – II Credit 3

1. **Kinetics**:
   a) **Physical degradation of pharmaceutical products**: Loss of water, absorption of water, loss of volatile constituents, polymorphism, color change.
   b) **Chemical degradation**: Hydrolysis, oxidation, isomerization, polymerization, decarboxylation, factors affecting chemical degradation etc.

c) **Chemical kinetics**: Definitions, rates and orders of reactions, methods for determination of orders of reactions, influence of temperature on rate of reactions, theories of reaction rates, decomposition of pharmaceutical products, accelerated test for physical, chemical and photochemical stability, stability aspects of formulations, marketed products and clinical supplies, shelf life determination.

2. **Interfacial phenomena**: Adsorption and interface, Freundlich and Langmuir isotherm, BET equation, electrical properties of interfaces, electrical double layer, Nernst and zeta potential, Gibbs equation, spreading, surface active agents, emulsifiers, detergents and antifoaming agents, surfactants and drug activity, surfactants and pharmaceutical products.
3. **Rheology and rheology of dispersed system**: Newtonian liquids, non-Newtonian materials, yield value, plastic and pseudo plastic flow, dilatant and thixotropic flow, viscosity of suspending agents.
4. **Colloids**: Classification, preparation, electrical and optical properties, sedimentation, Stoke's law, stability of colloidal dispersion, protective colloid, sensitization, dialysis, Donnan membrane equilibrium, application and uses of colloidal preparation in pharmacy.
5. **Electrochemistry**: Electrical units and their interrelation, Faradays laws of electrolysis and electrochemical equivalents, electrolytic conduction, equivalent conductance and the related facts, conductometric titrations, transference numbers and their determination.
6. **Electrochemical cells**: Electrode and cell potentials, energies involved in electrode processes, reference electrodes, buffer solutions and measurement of P^H; potentiometric titrations and oxidation- reduction systems, concentration cells.
7. **Micromeritics**: Importance of particle size determination, different means of expressing particle size, methods of particle size determination, optical and electron microscope studies, coulter counter methods, laser beam technique, sieve analysis, sedimentation methods, particle shape and surface area, measurement of particle surface area.

Recommended Books:

1. Principle of Physical Chemistry- M. Mahbubul Haque and M. Ali Nawab, Student Publication.
2. Physical Pharmacy- Alfred N. Martin, Pilar Bustamonte, Lippincott Williams and Wilkins.
3. Elements of Physical Chemistry- Macmillan
4. Physical Chemistry- P. W. Atkins, Peter Atkins, Julio De Paula, W. H Freeman and Company.
5. Essentials of Physical Chemistry- B. S. Bahl, G. D. Tuli and Arun Bahl, S. Chand and Company Ltd.
6. Quantitative analysis- V. Alexeyev, CBS Publishers.
7. Physicochernical Principles of Pharmacy- A. T. Florence and D. Attwood, Macmillan.
8. Text book of physical pharmaceutics – C.V.S. Subrahmanyyam

Pharm 216 Physical Pharmacy – II Lab Credit 1

1. Determination of adsorption isotherm of oxalic (or acetic) acid from aqueous solution by charcoal and calculation of the constant in Freundlich's equation.

2. Determination of energy of flow of a liquid through a capillary by measuring viscosity as a function of temperature.
3. Determination of the equilibrium constant of the reaction KI $+I_2$ = KI_3 at a known temperature.
4. Determination of the velocity constant of the hydrolysis of ethyl acetate in the basic medium.
5. Determination of viscosity of pure liquids such as glycerin, alcohol and nitrobenzene using Ostwald viscometer.
6. Determination of solubility of a sparingly soluble salt in water by conductance measurement.
7. Determination of velocity constant for the hydrolysis of an ester in the basic medium by conductance measurements.

Pharm 217 Biochemistry and Cellular Biology Credit 3

1. **Introduction to cell**: Differences between prokaryotic cells and eukaryotic cells, structure and functions of mitochondria and chloroplasts, cytoskeleton, cell development and differentiation.
2. **Plasma membrane, cell walls and cell surface**: Principle of semi-permeability, active transport, endocytosis, exocytosis, bacterial, fungal and plant cell walls.
3. **Nuclear structure and function**: Cell division and cell cycle, mitosis and meiosis, structure and function of chromosomes.
4. **Proteins**: Important bonds in protein, important functions of protein in biological system, importance of amino acid sequence in protein structure, different amino acids structures and functions, peptide bond, disulfide bridge in protein structure, peptide bond is rigid and planner, a helix, b sheet, hairpin turn, denaturation and renaturation of protein, proteins are rich in hydrogen-bonding potentiality, different structures of protein, conformational change of protein, gel electrophoresis, 2-D gel electrophoresis, purification of protein, synthesis of protein, protein sequencing, recombinant DNA technology for protein sequencing.
5. **Nucleic acids**: Importance of nucleic acid study, different bases of DNA/RNA, nucleotide, nucleoside, structures of DNA, DNA chain has polarity, AT/GC structure, melting point of DNA, physical states of DNA, Replication, discovery of DNA polymerase I and III, mRNA, hybridization studies of mRNA, synthesis of mRNA, recombinant DNA technology, restriction enzymes, promoter region of DNA, RNA synthesis termination, tRNA, role of tRNA in protein synthesis, codons, DNA sequencing.
6. **Enzymes**: Definition, activation energy and enzymes, specificity of enzyme, regulation of enzymes activity, enzymes and reaction equilibria, enzyme kinetics, enzyme inhibition, common features of enzymes, enzyme co-factors and coenzymes.

Recommended Books:

1. Biochemistry-J.M. Berg, J.L. Tymoczko and L. Stryer, Freeman .
2. Molecular Cell Biology- Lodish. H., et al .
3. Essential Cell Biology- B. Alberts et al. Pub. Garland .
4. Amazing Schemes within your Genes- Balkwill and Rolph, Collins
5. Instant Notes in Biochemistry- Hames, Hooper and Houghton, Bios Scientific Publishers.

6. Biochemistry – Leninger

Pharm 219 Pharmaceutical Microbiology-I Credit 3

1. **Introduction to Microbiology**: Microbiology as a field of biology, place of microbiology in the living world, prokaryotic and eukaryotic protists, group of microorganisms, areas of microbiology, application of microbiology.
2. **History and Evolution of microbiology**: Spontaneous generation and biogenesis; germ theory of diseases; pure culture concept; immunization; widening horizons.
3. **Microscopic observations of microorganisms**: Bright field, dark field, fluorescence and phase contrast microscopy, electron microscopy, preparations of microscopic examinations, wet mount and hanging drop techniques, fixed and stained smears, microbiological stains: simple and differential staining methods.
4. **Bacteria**: Nomenclature of bacteria, morphology and fine structures, nutritional requirements, bacteriological media, growth and reproduction, quantitative measurements of bacterial growth, maintenance and preservation of pure culture of bacteria.
5. **Microorganisms other than bacteria (brief study)**:
   a) **Yeasts** –Types, morphology, reproduction and physiology, pathogenic yeasts.
   b) **Rickettsiae** – Introduction, characteristics of rickettsiae, pathogenic rickettsiae, laboratory diagnosis of rickettsial diseases.
   c) **Viruses** – History of viruses, classification of viruses, characteristics of viruses, reproduction and cultivation of viruses, virus inhibition, control of virus infections, bacterial virus or bacteriophages, morphology and composition, cultivation of bacterial viruses, reproduction of bacterial viruses.

Recommended Books:

1. Microbiology- Michael J. Pelczar, Noel R. Kreig and E.C,S Chan. Tata Me Graw Hill Publishing Company Limited, New Delhi,
2. Microbiology An Introduction- Tortora, Berdell R.Funkee and Case, Prentice-Hall.
3. Biology of Microorganisms- TD Brock, MT Madigan, JM Martinko, and J. Parker, Prentice-Hall, Englewood Cliffs, NJ.
4. Prescott and Dunn's Industrial Microbiology- Samuel Cate Prescott, Cecil Gordon Dunn and Gerald Reed, Chapman and Hall.
5. Pharmaceutical Microbiology- Harris.
6. Fundamental Principles of Bacteriology- A.J. Salle, McGraw Hill Book Company.
7. Cooper and Gunn's Dispensing for Pharmaceutical Students- S. J Carter, Pitman Medical.
8. Microbiology- Lachman and Whistriche.
9. Pharmaceutical Microbiology- W. B. Hugo and A. D. Russel, Blackwell Science.

Pharm 220 Pharmaceutical Microbiology-I Lab Credit 1

1. Study of compound microscope
2. Preparation of pure bacterial cultures.
3. Preparation of pure culture and its identification.
4. Study of Gram-staining
5. Culture sensitivity test by disk-diffusion method
6. Minimum inhibitory concentration of antibiotic

Pharm 221 Physiology –Il Credit 3

1. **Nervous system**
   Neuron- properties, classification and functions. Neuroglial cells and their functions. Nerve fibers-Definition, types, properties of nerve fibers, origin and propagation of nerve impulses across nerve fibers, action potential. Synapse- classification, structure, properties and functions. Neurotransmitters- classifications and functions, nerve endings. Different types of sensations- Mechanism and properties of sensations, Receptors- definition, classifications, properties and functions. Reflex and reflex arc, their classifications, properties and components of reflex arc. Principal division of nervous system – CNS and PNS. Functions of different parts of CNS. Ascending and descending tracts of spinal cord. Differences between – somatic and autonomic and sympathetic and parasympathetic nervous system. Cranial and spinal nerves and their functions. Regulation of autonomic nervous system. Muscle tone- definition and regulation. Cerebro Spinal Fluid (CSF)- definition, composition and function.

2. **Endocrine System**
   Different endocrine glands and their structure and functions of pituitary, thyroid, parathyroid, adrenal and pancreatic glands. Functions and regulation of secretion of hormones. Abnormal hormone secretions and hormone deficiency diseases.

3. **Excretory System**
   Structure of kidney, nephron and its different parts. Renal circulation- its regulation and measurements. Renal clearance and its importance. Urine- its composition and properties. Counter current mechanism. Role of kidney in acid-base balance of blood and in maintenance of plasma volume

4. **Reproductive System**
   Testis and accessory reproductive systems and their functions. Male hormones and their functions. Spermatogenesis and its hormonal regulation.

   Organs of female reproduction system and their functions. Menstruation cycle, different phases and its regulation. Ovogenesis and ovulation and its control. Female sex hormones and their functions, pregnancy and lactation and their hormonal control.

5. **Regulation of body temperature**
   Heat production and heat dissipation, role of hypothalamus and other nerve factors in body temperature regulation, abnormalities in body temperature regulation

Recommended Books:

1. Human Physiology (Vol. I and II)- Chandi Charan Chatterjee, Medical Allied Agency, Calcutta.
2. A Text Book of Medical Physiology- Arther C. Guyton, W. B. Sander's Company, Appleton and Lange
3. Review of Medical Physiology- W. F. Ganong, Medical Publication.
4. A Text Book of Practical Physiology- C.L. Ghai, South Asia Books.
5. Gray's Anatomy- Spalding Gray, (International students edition), published by Churchill Livingstone.

Pharm 222 Physiology –Il Lab Credit 1

1. Microscopical study of blood cells: R.B.C., W.B.C., and platelets.
2. Estimation of Hemoglobin
3. Total count of R.B.C.
4. Total count of W.B.C.
5. Differential count of W.B.C.
6. Determination of clotting and bleeding time.
7. Examination of clot under the microscope.
8. Effect of chemical agents on R.B.C.
9. Fragility test of R.B.C.
10. Determination of Erythrocyte sedimentation rate.

Pharm 231 Pharmacognosy- II Credit 3

1. **Glycosides and glycoside containing drugs**. Classifications, source and use of different types of glycosides. Clinical and chemical aspects of Isothiocyanate: Mustard, Cyanogenetic: Wild Cherry, Antharaquinone glycosides: Cascara sagrada, aloe, senna, rhubarb, Saponins: Sarsaparila, glycyrrhiza, dioscorea, Cardiac: Digitalis, strophanthus, squill.
2. **Alkaloids**: Distribution, properties, tests, extraction, structure types and classification. The details of the following: a) Pyridine, piperidine: Areca, conium, b) Tropane: Belladonna, stramonium, hyoscyamus and coca, c) Quinoline: Cinchona, d) Isoquinoline: Ipecac, opium, e) Indole: Rauwolfia, nux-vomica, ergot, f) Imidazole: Pilocarpus, g) Steroidal: Veretrum viride, aconite, h) Purine bases: Coffee, tea, i) Lupinane: Lupinus etc.
3. **Volatile oils and related terpenoids**: Methods of obtaining volatile oils; Chemistry of the volatile oils and their medicinal and commercial uses.
4. **Phenolic compounds and tannins**: Chemical nature and test for tannins, some tannin containing drugs such as nutgall and catechu.
5. **Resin and resin combinations (resin, oleoresin, oleo gum resin, balsam)**: Jalap, cannabis, capsicum, ginger, myrrh, tolu balsam, and benzoin.
6. **Herbs as health foods**: Alfa alfa, apricot pits, arnica, garlic, onion, ginseng, spiriluna fenugreek, sassafras and honey.

7. **Poisonous plants and natural pesticides**: Datura, poison hemlock, water hemlock, foxglove (digitalis), ipomoea, tobacco, poppy, pyrethrum flower, derris and lanchocarpus, red squill, strychnine etc.

Recommended Books:

1. Pharmacognosy- Varro E. Tyler, Lynn R, Brady and James E, Robbers, Lea and Febiger, Philadelphia.
2. Pharmacognosy- Trease and Evans.
3. Pharmacognosy- Edward P. Claus, Varro E.Tyler, Lea and Febiger, Philadelphia.
4. Textbook of Pharmacognosy- T. E. Wallis, J and A Churchill.
5. Practical Pharmacognosy- Rasheeduz Zafar, CBS Publishers.
6. Natural Products, A Laboratory Guide - Raphael Ikan, Acadec Press, Inc., London.

Pharm 232 Pharmacognosy- II Lab Credit 1

1. General test for carbohydrates e.g. glucose, fructose, lactose, sucrose, maltose etc.
2. Examinations of starch and related products.
3. Extraction and identification of some anthraquinone derivatives from senna cascarda sagrada, aloe.
4. Extraction and isolation of caffeine from tea, coffee.
5. Separation of different substances by thin-layer chromatography (TLC)
6. Study of cardiac glycosides and some cardio-active drugs: Digitalis, squill, strophanthus.
7. Examination of some saponin containing drugs: sarsaparilla, discorea.
8. Study of alkaloids and some alkaloid containing drugs: Belladonna, stramonium, hyoscyamus, cinchona, ergot, ephedra, colchicum.

Pharm 201 Oral Examination (Semester-3) Credit 1

SECOND YEAR, SECOND SEMESTER

Pharm 229 Pharmaceutical Microbiology –II Credit 3

1. **Infectious diseases and causative organisms**.
2. **Basic concepts of Immunology**: Infection, pathogenicity, virulence and immunity.
3. **Immunological Products**: Active antigenic products, attenuated, inactivated and extract, viral and bacterial, passive products, gamma globulin.
4. **Sterilization**: (a) Sterilization by dry heat: principle, hot air oven and its method of use and applications. Advantages and disadvantages of sterilization by moist heat, factors affecting sterilization by moist heat, principle of sterilization by stem under pressure, (b) Sterilization by filtration; (c) Sterilization by radiation; (d) Sterilization by gas.

5. **Sterility testing and LAL testing methods of pharmaceutical products**.
6. **Microbiological assay of antibiotics**: Introduction, reference standard and units of activity, agar diffusion assay, theory of zone formation, factors affecting diffusion assay, dose response curve, large plate assay using latin square design, statistical interpretation of microbiological assay methods.
7. **Microbiological monitoring methods for pharmaceutical industry**: Different methods of microbial monitoring systems for environment in pharmaceutical industry.
8. **Disinfectants and antiseptics**.

Recommended Books:

1. Microbiology- Michael J. Pelczar, Noel R. Kreig and E.C,S Chan. Tata Me Graw Hill Publishing Company Limited, New Delhi,
2. Microbiology An Introduction- Tortara, Berdell R.Funkee and Case, Prentice-Hall.
3. Biology of Microorganisms- TD Brock, MT Madigan, JM Martinko, and J. Parker, Prentice-Hall, Englewood Cliffs, NJ.
4. Prescott and Dunn's Industrial Microbiology- Samuel Cate Prescott, Cecil Gordon Dunn and Gerald Reed, Chapman and Hall.
5. Pharmaceutical Microbiology- Harris.
6. Fundamental Principles of Bacteriology- A.J. Salle, McGraw Hill Book Company.
7. Cooper and Gunn's Dispensing for Pharmaceutical Students- S. J Carter, Pitman Medical.
8. Microbiology- Lachman and Whistriche.
9. Pharmaceutical Microbiology- W. B. Hugo and A. D. Russel, Blackwell Science.

Pharm 230 Pharmaceutical Microbiology –II Lab Credit 1

1. Sterility testing of sterile products
2. LAL test of water.
3. Microbial test of supply water
4. Settle plate tests
5. Swab test
6. Serial dilution and quantitative plate count method

Pharm 241 Pharmaceutical Technology-I Credit 3

1. **Liquid dosage forms**: Solution and elixirs, theory of solution, different factors affecting solution process, advantages and disadvantages, formulation consideration, manufacturing considerations, packaging of liquids, preservation and stability aspects, quality control of liquids.
2. **Dispersed system**:
   a) Properties of dispersed systems: Theoretical aspects of suspension, emulsion and colloids, surface char and zeta potential, inter- particle force, crystal growth, wetting, adsorption at solid-liquid interface, surface and interfacial tension, flocculation and coalescence.

b) Suspension: Advantages and disadvantages, aggregated and dispersed system, formulation of suspension, manufacturing of suspension, stability of suspension, evaluation and quality analysis of suspension, rheological consideration, illustrative examples.
c) Emulsion: Definition and applications, advantages and disadvantages, theory of emulsion, types of emulsion, formation of emulsion, classification of emulsifying agents, HLB values of surface active agents, formulation of emulsion, manufacturing of emulsion, stability of emulsion, evaluation and quality analysis of emulsion, rheological considerations, illustrative examples.

3. **Semisolids (Ointment, paste, gel)**: Structure of skin, percutaneous absorption of drugs, definition and classification of semisolid preparations, classification of bases, formulation, manufacturing, consideration, evaluation and quality analysis of semisolid preparations.
4. **Suppositories**: Drug absorption from colon, classification of suppositories, merits and demerits of suppository, suppository bases, formulation, manufacturing and testing of suppositories.

Recommended Books:

1. The Theory and practice of Industrial Pharmacy- Leon Lachmann, Herbert A, Liuberman, Joseph L. Kanig
2. Sprowi's American Pharmacy- Lewis W. Dittert.
3. Pharmaceutics: The Science of Dosage Form Design- Michael Aulton.
4. Remington's The Science and Practice of Pharmacy –Alfronso R. Gennaro.
5. Dispensing for Pharmaceutical Students- Cooper and Gunn.
6. Dispensing of Medication-Husa and Martin.
7. Bentley's Textbook of Pharmaceutics- E.A. Rawlings
8. Tutorial Pharmacy- Aulton.
9. An introduction to Pharmaceutical Formulations- Fishburn.
10. Cooper and Gunn 's Tutorial Pharmacy-S.J. Carter

Pharm 242 Pharmaceutical Technology-I Lab Credit 1

Preparations, problems encountered during preparation, physical evaluation of the different dosage forms (Syrup, Suspension and emulsion).

Pharm 243 Pharmaceutical Analysis– I Credit 3

1. **Aqueous acid-base titration**: Definition, distribution of acid-base species with P^H of the medium, acid-base titrimetry for determination of weekly acidic and basic pharmaceuticals, indicators (theories) and their selection, applications.
2. **Oxidation-reduction titration**: Principles and concepts, determination involving potassium permanganate, potassium dichromate, potassium bromate, Iodiometric and iodiometric determination, miscellaneous oxidation and reduction titration, indicators, applications of oxidation-reduction titration.
3. **Complexometric titration**: Introduction to complexometric titration, complexes and

chelates, stability of complex ions, titration based on complex formation, types of complexometric titration, techniques employed in chelometric titration, methods of end point detection, titration selectivity and masking reagents.

4. **Non aqueous acid-base titration**: Theoretical considerations and principles, Bronsted-Lowry theory of acids and bases, non aqueous solvents, titration of weak acids and weak bases, application and scope of non aqueous titration.
5. **Potentiometric titration**: Introduction, theory and principles, electrochemical cells and half-cells, electrodes, measurement of potential, application of potentiometric titration.
6. **Amperometric titration**: Introduction, theoretical considerations, instrumentation, general polarographic analysis, amperometric titration using one and two electrodes.
7. **Aquametry**: Principle and scope, physical methods of water determination, chemical method of water determination, Karl-Fischer procedure –principle, chemistry, methodology, equipment, end point detection and limitation.
8. **Testing of Pharmaceutical and potable waters**: Test for waters according to BP and USP, Total Organic Carbon (TOC) equipment and methods, Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD).
9. **Short study of (I) Refractometry (II) Polarimetry (III) Nephlometry (IV) Particle** analysis methods, such as, coulter counter and laser beam particle analyzers.

Recommended Books:

1. A Textbook of Pharmaceutical Analysis- Kennth A. Connors, John Wiley and Sons.
2. Pharmaceutical Chemistry- Lasie G. Chatten, Marcel Dekker Inc.
3. A Textbook of Quantitative Inorganic Analysis, Vol. I and 11- Aurther 1. Vogel, Long man, England.
4. United State Pharmacopoeia,United States Pharmacopoeia Convention, Inc.
5. British Pharmacopoeia
6. Quality Control in Pharmaceutical Industry- Murray S. Cooper, Academic Press.
7. Organic Spectroscopy- Philip Crews, Jamie Rodriguez and Marcel Jaspurs, Oxford University Press, New York, London.
8. Practical Pharmaceutical Chemistry, Parts I and II, - A. H. Backett and J. B. Stenlake, Athlone Press, London.
9. Introduction to Organic Laboratory Techniques- A Contemporary approach, D. L.Pavia, G. M. Lampman, G. S. Krij, W. B. Saunders Company, Philadelphia, London, Torento.

Pharm 244 Pharmaceutical Analysis– I Lab Credit 1

1. Determination of various physio-chemical parameters of drugs (melting point, pH, iodine value, optical rotation and light absorption).
2. Assay of drugs and dosage form by acid base, complexometric, iodometric and nitrite titration.

Pharm 251 Basic Pharmaceutics Credit 3

1. **Preformulation**: Preliminary evaluation and molecular optimization, bulk characterization of the material and polymorphism, thermal properties, particle characterization, bulk density, powder flow properties, solubility analysis, Pk_a determination, P^H solubility profile, effect of temperature, solubilization, partition coefficient, dissolution, stability analysis, solution stability, solid state stability.
2. **Chemical and Physical incompatibility**.
3. **Pharmaceutical excipients**: Chemistry, physical properties and uses of following excipients, acidifying agents, air displacement agents, alkalizing agent, antifoaming agents, antimicrobial preservatives, antioxidants, buffering agents, chelating agent, colors, complexing agents, emulsifying agents, flavoring agents and perfumes, humectant, ointment bases, solvents, Stiffening agents, wetting and solubilizing agent.
4. **Basic principles of compounding and dispensing**: Weight, measures and units calculation for compounding and dispensing, fundamental operation in compounding, good pharmaceutical practices in compounding and dispensing, containers and closures for dispensed products, responding to the prescription, labeling of dispensed medications.
5. **Pharmaceutical Calculations**: Mathematical principles, common and decimal fractions, exponents and power and root, logarithmic calculations, reducing and enlarging formulas, ratio and proportions, percentage calculations, ratio strength, stock solution, parts per million, dilution and concentration, temperatures, dosage calculations.
6. **Polymer Science for pharmaceuticals**: Pharmaceutical applications, physical, chemical and mechanical properties, molecular weight and distribution, polymer solution properties, plasticization and elastomers.

Recommended Books:

1. The Theory and practice of Industrial Pharmacy- Leon Lachmann, Herbert A, Liuberman, Joseph L. Kanig
2. Sprowi's American Pharmacy- Lewis W. Dittert.
3. Pharmaceutics: The Science of Dosage Form Design- Michael Aulton.
4. Remington's The Science and Practice of Pharmacy –Alfronso R. Gennaro.
5. Dispensing for Pharmaceutical Students- Cooper and Gunn.
6. Dispensing of Medication-Husa and Martin.
7. Bentley's Textbook of Pharmaceutics- E.A. Rawlings
8. Tutorial Pharmacy- Aulton.
9. An introduction to Pharmaceutical Formulations- Fishburn.
10. Cooper and Gunn 's Tutorial Pharmacy-S.J. Carter
11. Hand book of pharmaceutical excipients – Arthur H. Kibbe

Pharm 261 Pharmacology-I Credit 3

1. Definition of pharmacology, drug, medicine, prodrug, pharmacokinetics, pharmacodynamics, agonist, antagonist, synergism, side effect, toxicity, teratogenicity, drug interaction, drug tolerance, drug dependence, drug abuse, idiosyncrasy, dose, dosage form, absorption, distribution, bioavailability, distribution, protein binding, metabolism and excretion, routes of drug administration.

2. **Basic concept of drug action**: Receptor, nature of receptor, drug antagonism, relation between drug dose and clinical response.
3. Signalling mechanism and drug action, legand gated channels, G-proteins and second messengers.
4. **Drugs for peptic ulcer**: antacid, H_2-receptor, proton pump inhibitors, PG analogues, mucosal-protective agent, anti *Helicobacter pylori* agents.
5. **Anticoagulant**: Heparin, calcium complexing agents, oral anticoagulants.
6. **Autacoids**: Amine, lipid and peptide autacoids.
7. **Haematinic drugs**: Iron, vit B_{12} , folic acid erythropoietin.
8. **Sedative and hypnotic drugs**: Benzodiazepine and barbiturates.
9. **CNS stimulant drugs**: Strychnine, xanthine and methylxanthine, amphetamine, nicotine.
10. **Chemotherapy of parasites**: Drugs used in helminthiasis, malaria, leishmaniasis and trichomoniasis.

Recommended Books:

1. Goodman and Gillman's Pharmacological Basis of Therapeutics- Hardman, Joel G., McGraw Hill Incorporated.
2. Basic and Clinical Pharmacology- Bertram G. Katzung, Me Graw Hill Companies.
3. Medical Pharmacology-Andres Goth, Toppan Co. Ltd.
4. Pharmacology and Pharmacotherapeutics- R. S. Satosker, Paperback, Popular Prakashani Ltd. India.
5. Clinical Pharmacology- D, R. Laurence, P. N. Bennett and M. J. Brown, Churchill Living stone.
6. Clinical Pharmacy and Therapeutics - Roger walker and Clive Edwards, Churchill Living stone.

Pharm 262 Pharmacology-I Lab Credit 1

1. Estimation of glucose, cholesterol and urea in blood
2. Estimation of drug in blood after administration (e.g. paracetamol, aspirin).
3. Brine Shrimp lethality bioassay
4. Effect of drugs in animal: Local anesthetics, Diuretics, analgesics.

ORE 202 Oral Examination (Semester- 4) Credit 1

THIRD YEAR, FIRST SEMESTER

Pharm 305 Pharmaceutical Marketing Credit 3

1. Principles of marketing
2. Strategic marketing planning
3. Consumer markets and buying behavior
4. Market segmentation and target market strategies
5. Product promotion
6. Advertising
7. Products: Planning and development
8. Positioning and product life cycle
9. Branding
10. Pricing

Recommended Books:

1. Marketing Management - Philip Kotler and Garry Armstrong
2. Basic Principles of Marketing - Jeorge R. Terry

Pharm 333 Medicinal Chemistry-I Credit 3

1. **Reaction mechanisms:**
   a) Addition reaction: Electrophilic; nucleophilic and free-radical; 1,2- and 1,4- addition.
   b) Substitution reaction: Unimolecular (S_N1) and bimolecular (S_N2), stereochemistry of S_N1 and S_N2 reaction, free-radical and intermolecular nucleophilic substitution.
   c) Elimination reaction: Unimolecular (E1) and bimolecular (E2), stereochemistry of elimination reaction.
   d) Rearrangement reaction: Hofmann, Claisen, Sigmatropic and Fries rearrangement.
2. **Name reactions**: Arndt- Eistertd, Baklelite, Baeyer-Villiger, Birch reduction, Clemmensen reduction, Darzens condensation, Diels Alder, Eschweiler-Clarke, Friedel- Crafts, Gabriel synthesis, Gettermann- Koch and Sandmeyer, Grignard, Hofman, Mannich, Michael, Meerwin- Pondorf- Verley, Oppenauer oxidation, Perkin, Reformatsky, Reimer- Tiemann, Vilsmeier- Haack, Witting and Wolf-Kishner reduction.
3. **Carbohydrates**: General considerations, chemistry, stereochemistry, classification, aldoses, ketones, oxidation, effect of alkali, Kiliani- Fisher synthesis of aldoses, Ruff degradation, optical family, D-L, R-S cyclic structures of D (+) glucose, hemiacetal, acetal form of glucose. Disaccharides and polysaccharides.
4. **Lipids**: General consideration, chemistry, fatty acid cycle, β- oxidation, catabolism of unsaturated fatty acids, ketone bodies, ketosis, ketourea, ketoacidosis.
5. **Amino acids and proteins**: General considerations, structure of amino acids, acidity and basicity of amino acids, α-toposide, reactions of amino acids, essential amino acids. Reactions of proteins.
6. **Vitamins**: The clinical aspects of the vitamins and there effects on free radicals, synthesis of the vitamins such as Vit-B_1, Vit-C, nicotinamide, pyridoxine, mechanisms of the action of the vitamins.

Recommended Books:

1. Willson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry- Jaime N. Delgado and Willium A. Remers, LippincottRaven, Philadelphia Newyork.
2. Burger's Medicinal Chemistry and Drug Discovery- Donald J. Abraham, John Wiley and Sons.
3. Essentials of Medicinal chemistry- Andrejus Korolkovas, John Wiley and Sons.
4. Organic Chemistry- Robert Thornton Morrison and Robert Neilson Boyd, Prentice, Hall of India Private Limited.
5. Heterocyclic Chemistry- J. A. Joule and G. F. Smith, English Language book Society.
6. Foye's Principles of Medicinal Chemistry- David A. Williams and Thomas L. Lemke, Lippincott Williams and Wilkins.
7. Medicinal Chemistry: Principles and Practice- Frank D. King, The Royal Society of Chemistry.
8. An Introduction to Medicinal Chemistry- Graham L. Patrick, Oxford University Press.
9. Medicinal chemistry - Gareth Thomas

Pharm 334 Medicinal Chemistry-I Lab Credit 1

1. Study of Addition, Substitution and Elimination Reactions.
2. Synthesis of organic compounds of medicinal importance (Phenacetin, PABA, meta nitro benzaldehyde, ethyl para hydroxyl benzoate, para amino phenol, methyl salicylate).
3. Synthesis of some drugs (paracetamol, benzocaine, aspirin).

Pharm 341 Pharmaceutical Technology-II Credit 3

1. **Formulation and manufacturing of tablets**: Definition, types, preparation, additives and components of tablets, manufacturing of tablets by wet granulation, dry granulation and by direct compression, granulation of powders for tableting, advantages and disadvantages of different process, processing machineries used in tablet manufacturing.
2. **Common tableting problems and evaluation of tablets**: Hardness measurement, weight variation tests, thickness and diameter, friability, disintegration time, dissolution time, mechanism of tablet disintegration and dissolution, in process quality control methods in tablet manufacturing, study of common tableting problems.
3. **Compaction and compression of powder**: Physics of tablet compression, mechanisms of compression of particles, bonding of tablets, the effect of compression force on tablet properties, effect of lubricant on tablet compression and binding, instrumented tablet machine and tooling, problems associated with large scale manufacturing of tablets.
4. **Tablet coating**: Definitions and classification of coating methods, advantages and disadvantages of coated tablets, different methods of coating: sugar coating, different stages of sugar coating, problems of sugar coating; film coating, film formers, plasticizer, solvents, other excipients; comparison between sugar coating and film coating, aqueous film coating techniques, modern film coating materials and coating formulations, problems of organic and aqueous film coating; film testing; film coating problems; physiological availability and film coating; coating machines.

5. **Hard gelatin capsules**: Definition and classification, advantages and limitations of capsule dosage form, gelatin and its manufacture, manufacture of hard capsule shells, properties of capsules, formulation of capsules, capsule filling machines, tooling and accessories, problems in capsule manufacturing, quality control methods of capsules, packaging of capsules.
6. **Soft gelatin capsules**: Definitions and classifications, advantages and limitations, properties of soft capsules, formulation of soft capsules, manufacturing of soft capsules, problems in soft capsule manufacturing, quality control methods of soft capsules, packaging of soft capsules.
7. **Microencapsulation technology**: Purpose, methods of preparation, evaluation, pharmaceutical and biological applications of microencapsulation process.

Recommended Books:

1. The Theory and practice of Industrial Pharmacy- Leon Lachmann, Herbert A, Liuberman, Joseph L. Kanig
2. Sprowi's American Pharmacy- Lewis W. Dittert.
3. Pharmaceutics: The Science of Dosage Form Design- Michael Aulton.
4. Remington's The Science and Practice of Pharmacy –Alfronso R. Gennaro.
5. Dispensing for Pharmaceutical Students- Cooper and Gunn.
6. Dispensing of Medication-Husa and Martin.
7. Bentley's Textbook of Pharmaceutics- E.A. Rawlings
8. Tutorial Pharmacy- Aulton.
9. An introduction to Pharmaceutical Formulations- Fishburn.
10. Cooper and Gunn 's Tutorial Pharmacy-S.J. Carter
11. Hand book of pharmaceutical excipients – Arthur H. Kibbe

Pharm 342 Pharmaceutical Technology-II Lab Credit 1

Preparations, problems encountered during preparation, physical evaluation of the different dosage forms (Suppository, ointments, tablet, capsule and powder dosage form).

Pharm 353 Biopharmaceutics and Pharmacokinetics-I Credit 3

1. **Introduction of Pharmaceutics and Biopharmaceutics**
2. **Gastrointestinal absorption of drugs**:
   a) Biological Consideration: Membrane physiology, gastrointestinal physiology, mechanism of absorption etc.
   b) Physicochemical consideration: Pk_a and gastrointestinal absorption, pH-partition theory and other physicochemical factors.
   c) Dosage form consideration: Role of different dosage form like solution, suspension, tablet, capsule, emulsion etc. on gastrointestinal absorption.
   d) Disintegration and dissolution of drugs.

3. **Distribution of drugs**:

a) Important pharmacokinetic parameters such as biological half-life, apparent volume of distribution, area under the curve, elimination rate constant etc.

b) Interpretation of drug-plasma level curve.

c) Drug-protein Interaction: Theoretical aspect of protein-drug interaction, methods used for protein binding, identification of drug binding sites, kinetics of protein binding, determination of binding sites and association constant, factors affecting protein binding, effects of protein binding on drug distribution, elimination and pharmacological effects of drugs.

4. **Drug Clearance**:

a) Theoretic aspects of drug elimination, excretion and biotransformation.

b) Renal elimination: Glomerular filtration, active tubular secretion, tubular reabsorption, determination of renal clearance.

c) Hepatic elimination: Biotransformation of drugs in the liver, drug biotransformation reactions, pharmacokinetics of drugs and metabolites (Michelis Menten Equation), first pass effect, liver excretion ratio, relation between absolute bioavailability and liver excretion, hepatic clearance- relationship among blood flow, intrinsic clearance and hepatic clearance, hepatic clearance of a protein bound drug (effect of protein binding on hepatic clearance).

d) Biliary excretion of drugs.

5. **Bioavailability and Bioequivalence**: Definitions of different parameters relative to bioavailability; purpose of bioavailability, relative and absolute bioavailability, methods of assaying bioavailability, criteria for bioequivalence studies.

6. **Drug product selection** on the basis of bioavailability testing.

Recommended Books:

1. Biopharmaceutics and Clinical Pharmacokinetics - Milo Gibaldi, Le and Febiger, Philadelphia.
2. Applied Biopharmaceutics and Pharmacokinetics – Leon Shargel and Andrew Yu.
3. Blopharmaceutics and Clinical Pharmacokinetics- Notari, R. E., Marcel Dekker Inc.
4. Biopharmaceutics and Relevant Pharmacokinetics- T. G. Wagner and M. Pernarowski, Hamilton Drug Intelligence Publication.
5. Biopharmaceutics and Drug Interactions- Donald E. Cadwaller, Raven Press, Newyork.
6. Pharmacokinetics- M. Gibaldi and D. Perrier.

Pharm 354 Biopharmaceutics and Pharmacokinetics-I Lab Credit 1

1. In process test of various dosage forms (DT, weight variation, pH, wt/ml, etc).
2. In vitro dissolution study of tablets.

Pharm 361 Pharmacology-II Credit 3

1. **Local anesthetic**: History, mechanism of action, properties, SAR, pharmacological action, fate, ester and amide type local anesthetics.
2. **General anesthetic**: Inhaled anesthetics: nitrous oxide, halothane, enflurane, isoflurane and sevoflurane. Intravenous anesthetics – barbiturates, benzodiazepines and opiod analgesics,
3. **Analgesic, antipyretic and antinflammatory drugs**: Non-narcotic analgesic- salicylates, pyrazolone derivatives, para-aminophenole derivatives, propionic acid derivatives, indomethacin, sulindac,tolmetin, diclofenac; Narcotic analgesic -opium alkaloids, morphine antagonist, synthetic and semisynthetic opiate.
4. **Cardiovascular drugs**:
   a. Antihypertensive drugs

   b. Antiarrhythmic drugs.

   c. Diuretics

   d. Drugs used in heart failure

   e. Drugs used in angina and myocardial infarction

5. **Antifungal drugs**: Amphoterecin B, flucytosine, itraconazole, keloconzole, fluconazole, nystatin, griseofulvin

6. **Antibacterial agents**:

   a. Drugs affecting folate synthesis: sulfonamide, trimethoprim
   b. β-lactam antibiotics: Penicillin,cephalosporin.
   c. Drugs affecting protein synthesis: Tetracycline, chloramphenicol, macrolides, aminoglycosides.
   d. Drugs affecting topoisomerase-I enzyme: Fluoroquinolones.
   e. Glycopeptide, polymyxin, bacitracin and nitrofurantoin antibiotics.
   f. Antitubercular agents: Isoniazid, rifampin, ethambutol, pyrazinamide, PAS, capreomycin, cycloserine, ethionamide.
   g. Antileprotic drugs: Dapsong, rifampin,clofazimine.
7. **Vitamin**: Water soluble and fat soluble vitamins.
8. **Antidiabetic agents**: Introduction to diabetes, classification, causes, complications and treatment of diabetes. Hypoglycemia, causes and treatment, relationship between stroke and diabetes, causes of stroke. Different types of anti-hyperglycemic agents with structures, mechanisms, uses, toxicity. Insulin resistance, management of diabetes. glucagon structure, mechanism and uses.

Recommended Books:

1. Goodman and Gillman's Pharmacological Basis of Therapeutics- Hardman, Joel G.,

McGraw Hill Incorporated.
2. Basic and Clinical Pharmacology- Bertram G. Katzung, Me Graw Hill Companies.
3. Medical Pharmacology-Andres Goth, Toppan Co. Ltd.
4. Pharmacology and Pharmacotherapeutics- R. S. Satosker, Paperback, Popular Prakashani Ltd. India.
5. Clinical Pharmacology- D, R. Laurence, P. N. Bennett and M. J. Brown, Churchill Living stone.
6. Clinical Pharmacy and Therapeutics, Roger walker and Clive Edwards, Churchill Living stone.

Pharm 371 Pathology Credit 3

1. Definition and scope of pathology, concept of diseases
2. Cellular injury and adaptation: Morphology of injured cells, intracellular accumulation, sub-cellular alteration, adaptation, and neuralgia.
3. Inflammation and repair: Morphological patterns and changes in vascular flow and permeability, phagocytosis, chemical mediators, mechanisms of regeneration and repairing, gastritis, ulceration, pleuritis, cervicitis.
4. Pathological calcification
5. Body defense mechanisms
6. Nutritional diseases: Maresmus-kwashiorkor, deficiency states of vitamins and minerals.
7. Neoplasia: Characteristics, grading and stages of cancer, metastasis, karyotype changes in tumour, carcinogenic agents and their cellular interaction, oncogenes and cancer, sarcomas.
8. Hemodynamic disorders: Edema, hyperemia, congestion, hemorrhage, hemostasis, thrombosis, embolism, shock.
9. Infectious disease: Herpes simplex, AIDS, diphtheria, whooping cough, tuberculosis, syphilis, plague, tetanus, giardiasis, thrichomoniasis, pneumonia, filariasis, etc.
10. Immunological disease.
11. Name, Definition and examination of all common pathological tests and the standard values.

Recommended Books:

1. Robinn's Pathological Basis of Disease- Ramzi S. Cotran, Vinay Kumar, Tucker Collins, Stanley L. Robbins, W.B Sander's Company, Philadelphia.
2. General Pathology- J. B Walter and M. S Israel, Churchill Livingstone, Edinburgh.
3. Practical pathology and Microbiology- M.A Khaleque.

ORE 301 Oral Examination (Semester- 5) Credit 1

THIRD YEAR, SECOND SEMESTER

Pharm 307 Pharmaceutical Management Credit 3

1. **Nature and Principles of Management**: Style of management, the MBO system and improving decision-making.
2. **Organization Structures**: Social organization and legal organization, the sole proprietorship, the general partnership, private and public limited companies, their relative advantages and disadvantages.
3. **Personal management**: Importance, principles, methods, motivation, staff requirements theory.
4. **Planning, organizing, staffing, landing and controlling**.
5. **Managerial role of pharmacists**: pharmacists in different services of health and pharmaceutical industry, marketing and sales, regulatory affair research and development, hospital pharmacy, community pharmacy.
6. **Inventory Control**: Methods: Intuitive, systematic wantbook, perpetual inventory, open-to-buy, stock, record card, economic order quality, selection of optimum methods, effect of inventory control.
7. **Purchasing**: Formulating effective buying policies, needs and desires, selecting the sources of supply, determining terms of purchase, receiving, marking and stocking of goods.

Recommended Books:

1. Management: A global perspective - Weirich, Heinz and Koontz
2. Principles and Methods of Pharmacy Management - H.A. Smith

Pharm 335 Medicinal Chemistry – II Credit 3

1. **Stereochemistry**:
   a) General treatment of different types of isomerism
   b) Geometric isomerism of alkenes and cyclic compounds, Cis, trans and (E), (Z) systems of nomenclature
   c) Conformational isomers: Conformation of open chain and cyclic compounds
   d) Chirality of molecules: Enantiomer, diastereomer, racemic modification, meso compound, R-and S-configuration, sequence rule, optical rotation
   e) Asymmetric synthesis: Preparation of enantiomer by asymmetric synthesis and optical resolution method
   f) Stereoselective and stereospecific reaction
   g) Pharmaceutical importance of studying stereochemistry
2. **Heterocyclic chemistry**:
   a) 5-membered heterocyclic compounds: Pyrrole, furan, thiophene, pyrazole, imidazole, oxazole, isoxazole, thiazole and isothiazole: their preparations, reactions and pharmaceutical importance

b) 6-membered heterocyclic compounds: Pyridine, piperidine, pyrimidine, pyradazine, pyrazine and triazine: their preparation, reaction and pharmaceutical importance
c) Benzofused 5-membered heteroatomic compounds: Indole, benzofuran, benzothiaphene and carbazole: their chemistry, synthesis and pharmaceutical importance
d) Benzofused 6-membered heteroatomic compounds: Quinoline and isoquinoline: their chemistry, synthesis and pharmaceutical importance.

3. **Chemistry, SAR, mode of action and synthesis of following groups of drugs**:
   a) Antibiotics
   b) Antihistamines
   c) Analgesics and anti-inflammatory agents
   d) Hypnotics and sedatives
   e) Cardiovascular agents
   f) Diuretics
4. **Drugs metabolism**: Pathways of drugs metabolism, metabolism of various groups of drugs; factors affecting drug metabolism, methods of studying drug metabolism, new aspects of drug metabolism; metabolic products of common drugs.

Recommended Books:

1. Willson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry- Jaime N. Delgado and Willium A. Remers, LippincottRaven, Philadelphia Newyork.
2. Burger's Medicinal Chemistry and Drug Discovery- Donald J. Abraham, John Wiley and Sons.
3. Essentials of Medicinal chemistry- Andrejus Korolkovas, John Wiley and Sons.
4. Organic Chemistry- Robert Thornton Morrison and Robert Neilson Boyd, Prentice, Hall of India Private Limited.
5. Heterocyclic Chemistry- J. A. Joule and G. F. Smith, English Language book Society.
6. Foye's Principles of Medicinal Chemistry- David A. Williams and Thomas L. Lemke, Lippincott Williams and Wilkins.
7. Medicinal Chemistry: Principles and Practice- Frank D. King, The Royal Society of Chemistry.
8. An Introduction to Medicinal Chemistry- Graham L. Patrick, Oxford University Press.
9. Medicinal chemistry - Gareth Thomas

Pharm 336 Medicinal Chemistry – II Lab Credit 1

Synthesis of various drugs (Ibuprofen, Diclofenac, Nicotinamide etc.)

Pharm 343 Pharmaceutical Analysis-II and Quality Assurance Credit 3

1. **Introduction to visible and ultraviolet spectrophotometry**.
2. **Chromatographic methods**: Principle and applications of different chromatographic methods: column chromatography, thin layer chromatography, and gel filtration, high performance liquid chromatography (HPLC) and gas chromatography etc.

3. **HPLC**: Detail study of HPLC techniques and its applications in pharmaceutical analysis. Different detector systems and columns used in pharmaceutical analysis.
4. **Fluorometry**: Introduction, theoretical principle, fluorescence and chemical structure, instrumentation, factors influencing intensity of fluorescence, comparison of fluorometry and spectrophotometry, applications of fluorometry in pharmaceutical analysis.
5. **Quality assurance, GMP and quality control**: Detail study of WHO cGMP guide line and good laboratory practice (GLP).
6. **Sampling, sampling plan and control charts**.
7. **Hazards associated with chemicals and laboratory safety**.
8. **Calibration and validation**: Study of analytical methods validation.

Recommended Books:

1. A Textbook of Pharmaceutical Analysis- Kennth A. Connors, John Wiley and Sons.
2. Pharmaceutical Chemistry- Lasie G. Chatten, Marcel Dekker Inc.
3. Quality Control in Pharmaceutical Industry- Murray S. Cooper, Academic Press.
4. Organic Spectroscopy- Philip Crews, Jamie Rodriguez and Marcel Jaspurs, Oxford University Press, New York, London.
5. Practical Pharmaceutical Chemistry, Parts I and II - A. H. Backett and J. B. Stenlake, Athlone Press, London.
6. World Health Organization Quality assurance-WHO
7. Good manufacturing practices for pharmaceuticals a plant for total quality control-Stocker
8. WHO: Expert committee Specifications Pharmaceutical preparations 36 Report

Pharm 344 Pharmaceutical Analysis-II and Quality Assurance Lab Credit 1

1. Determination of potency of different excipients, drugs and Dosage form by spectrophotometry.
2. Determination of potency of different excipients, drugs and Dosage form by HPLC.
3. Identification of drugs by chromatography methods.
4. Bioassay of drugs.

Pharm 349 Pharmaceutical Engineering- I Credit 3

1. **The fundamentals of unit operations**: Fluid flow, heat transfer and mass transfer.
2. **Drying**: Definition, importance of drying, terminology, theory and fundamental concepts, periods of drying, constant rate period, falling rate period, critical moisture content, equilibrium moisture content, classification, direct, indirect, radiation, batch and continuous, dielectric, types of beds static, moving, fluidized, pneumatic bed systems, different drying equipments, construction, operation, merits, demerits, tray dryer, through-circulation dryer, pneumatic conveying, rotary dryer, spray dryer, tunnel dryer, steam tube rotary dryer, agitated pan dryer, vacuum rotary dryer, selection of drying equipment, preliminary dryer selection, drying tests, final selection. Freeze drying: Definition, application, basic

principles, and basic elements.

3. Size reduction and classification.
4. **Filtration**: Definition, importance of filtration, difference with expression, sedimentation and drying, classification of filters, theory of filtration, filter media, filter aids, filter thickeners, different filtration equipment, construction, operation, merits, demerits, the gravity nutsche, delpark industrial filter, bag filters, sand filters, plate and frame press, recessed plate filter press, eimco-burwell plates and frames, readco short cycle filter, vertical pressure leaf filter, horizontal plate filter, industrial tubular filter, Rodney hunt pressure filter, moore filter, vacu-flow suction leaf filter, string discharge filter, clarifying filters, selection of filtration equipments.
5. **Centrifugation**: General principles, magnitude of centrifugal force, materials of construction, critical speed, sedimentation centrifuges, filtering centrifugals, centrifuge auxiliaries, drive mechanisms, feed and discharge lines, feed treatment, costs, selection of centrifugal separators.
6. **Solid-solid mixing**: Importance, fundamentals, batch homogenicity, types of solids-mixing machines, mixing mechanisms and operations, double cone, twin shell, horizontal drum, double-cone revolving around long axis, ribbon, vertical screw, batch muller, continuous muller, twin rotor, performance characteristics, selection of machines.
7. **Paste mixing**: Definition, importance, simple blending, dispersion operations, general equipment design, standard types of equipment and operations, change-can mixer, change-can mixer with planetary motion, change-can mixer with rotating turntable, troy angular mixer, duplex mixer, stationary-tank mixer, kneader, mullers, three-roll mill, selections of process and mixer.
8. **Liquid mixing**: Definition, importance, mixing equipment, axial and radial flow, Impellers, mechanisms, flow patterns, impellers, flat-blade and curves-blade turbines, spiral turbines, paddles, gate impellers, anchor impellers, different fixed-mounted and portable positions, shaft lengths, baffled and unbaffled tanks, vortex formation and its control, costs, selection of impeller.
9. **Ideal premises for pharmaceuticals**: Principle, design, characteristics, lay-out, modern concept of premises.

Recommended Books:

1. Pharmaceutical Engineering- K. Sambamurthy.
2. Pharmaceutical Engineering- C.V.S. Subrahmauyan.
3. Perry's chemical Engineering Handbook- Robert H. Perry.
4. The Theory and practice of Industrial Pharmacy- Leon Lachmann, Herbert A, Lieberman, Joseph L. Kanig.
5. Sprowi's American Pharmacy- Lewis W. Dittert.
6. Pharmaceutics: The Science of Dosage Form Design- Michael Aulton.
7. Pharmaceutical Dosage Forms, Tablet (Vol: 1, 2 and 3) - Herbert Lieberman, Leon Lachman, Joseph B. Schwartz.

Pharm 355 Biopharmaceutics and Pharmacokinetics-II Credit 3

1. **Introduction to compartment**:

(a) One-compartment open model: Determination of plasma concentration from one compartment open model, elimination rate constant, apparent volume of distribution, calculation of K from urinary data.

(b) Multiple compartment models: (i) Two-compartment open model, method of residuals, apparent volumes of distribution, drug in tissue compartment, elimination rate constant (ii) Three compartment open model, method of residuals, determination of area under curve, apparent volumes of distribution, elimination rate constant.

2. **Pharmacokinetics of drug absorption**: Zero-order absorption model, first- order absorption model, determination of absorption rates constant from oral absorption data.

3. **Multiple Dosage Regimens (MDR)**: Drug accumulation, repetitive intravenous injection, multiple oral dosage regimens, loading dose and determination of bioavailability and bioequivalence from MDR.

4. **Intravenous infusion**: One-compartment model drugs, two-compartment model drugs, infusion plus loading dose.

5. Dosage adjustment in renal and hepatic diseases:

(a) Pharmacokinetic considerations, general approaches for dose adjustment in renal disease, dose adjustment based on drug clearance, dose adjustment based on the elimination rate constant, measurement of glomerular filtration rate (GFR), calculation of creatinine clearance from serum creatinine concentration, dose adjustment based on nomogram, Giusti-Hayton method, Wagner method.

(b) Extracorporeal removal of drugs.

6. **Non-compartmental analysis**: Physiologic-pharmacokinetic model, statistical moment, mean residence time etc.

7. **Relationship between pharmacokinetic and pharmacologic responses**.

Recommended Books:

1. Biopharmaceutics and Clinical Pharmacokinetics - Milo Gibaldi, Le and Febiger, Philadelphia.
2. Applied Biopharmaceutics and Pharmacokinetics – Leon Shargel and Andrew Yu;
3. Blopharmaceutics and Clinical Pharmacokinetics- Notari, R. E., Marcel Dekker Inc.
4. Biopharmaceutics and Relevant Pharmacokinetics- T. G. Wagner and M. Pernarowski, Hamilton Drug Intelligence Publication.
5. Biopharmaceutics and Drug Interactions- Donald E. Cadwaller, Raven Press, Newyork.
6. Pharmacokinetics- M. Gibaldi and D. Perrier.

Pharm 356 Biopharmaceutics and Pharmacokinetics-II Lab Credit 1

1. In vitro bio-availability study of various dosage form: (a) Tablet (Normal release and modified release) (b) Capsule (c) Suppository
2. In vivo bio-availability study of drug: (a) Determination of concentration of aspirin in urine after oral administration (b) Estimation of paracetamol in blood after oral administration.
3. Study of in vitro – in vivo correlation.

ORE 302 Oral Examination (Semester- 6) Credit 1

FOURTH YEAR, FIRST SEMESTER

Pharm 435 Medicinal Chemistry-III Credit 3

1. **Drug discovery and Drug design**: Source of drugs, cost and place of development of drugs, search for new drugs, genesis of drugs: (i) serendipity (ii) random Screening (iii) extraction from natural sources (iv) molecular modification (general process, special process- ring closure or opening, formation of lower or higher homologues, removal or replacement of bulky groups, isosteric substitution, change of position or certain groups, introduction of alkylating moieties, modification towards inhibition or promotion of various electronic states). Methods of lead optimization (Topliss sequential method), Fibonacci search, sequential complex optimization (v) selection or synthesis of soft drugs, soft analogues, activated soft compounds, natural soft drugs, soft drugs based on the active metabolite approach, soft drug based on inactive metabolite approach (vi) prodrugs (vii) rational drugs design, antimetabolites, enzyme inhibitors, (viii) application of quantum mechanics computer aided drug designing (CADD).
2. **Chemistry, mode of action, SAR and synthesis of** :
   (a) Antihypertensive agents (ß-blockers) (b) H_2-blockers (c) Psychrotropic drugs and antidepressants (d) Antidiabetic drugs (e) semisynthetic penicillins (f) cephalosporins (g) quinolone derivaties (h) oral contraceptives and steroidal hormones (i) anticancer drugs.

3. **Combinatorial chemistry** : (a) combinatorial synthesis: Introduction to drug discovery process (b) library synthesis on resin beads – solid phase chemistry, resin beads, speeding up of peptide synthesis, mix and split library synthesis (c) solution phase, indexed combinatorial libraries, template-based libraries, liquid phase combinatorial synthesis, (d) encoded combinatorial synthesis-encoded requirements. Examples of tagged libraries, (e) solid phase library, chemistry of linkers, carboxylic acid linkers, carboxamide linkers, alcohol linkers, amine linkers, traceless linkers, light cleavable linkers, selected solid phase chemistry (f) analysis of products with different analytical techniques, infra-red, solid phase NMR (g) combinatorial chemistry: applications and impact on drug discovery.

Recommended Books:

1. Willson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry- Jaime N. Delgado and Willium A. Remers, LippincottRaven, Philadelphia Newyork.
2. Burger's Medicinal Chemistry and Drug Discovery- Donald J. Abraham, John Wiley and Sons.
3. Essentials of Medicinal chemistry- Andrejus Korolkovas, John Wiley and Sons.
4. Organic Chemistry- Robert Thornton Morrison and Robert Neilson Boyd, Prentice, Hall of India Private Limited.
5. Heterocyclic Chemistry- J. A. Joule and G. F. Smith, English Language book Society.
6. Foye's Principles of Medicinal Chemistry- David A. Williams and Thomas L. Lemke, Lippincott Williams and Wilkins.
7. Medicinal Chemistry: Principles and Practice- Frank D. King, The Royal Society of Chemistry.
8. An Introduction to Medicinal Chemistry- Graham L. Patrick, Oxford University Press.
9. Medicinal chemistry - Gareth Thomas.

Pharm 437 Pharmaceutical Regulatory Affairs Credit 3

1. Regulations and laws governing the practices of pharmacy in Bangladesh (**The Pharmacy Ordinance, 1976**).
2. Policies, sales, regulation and laws concerning to the manufacture, possession, distribution, sale of drugs and poisons.
3. **The Drug Act, 1940, The Poisons Act, 1919** and related amendments, **The drug (control) ordinance, 1982, The Drug Policy, 1982, The Narcotics (control) Act, 1990, The drug policy, 2006**
4. **Approval process**, format and registration of pharmaceuticals in Bangladesh.
5. Rules and regulations for controlling poisons and narcotic materials in Bangladesh.
6. **Control of drug advertisements and prices** patented and trademarked medicine, proprietary medicine, regulation of cosmetics and poison control.
7. Schedules of drugs and poisons.
8. **Drug autohority of Bangladesh**: Functions and activites of directorate of drug administration, drug registration methods in Bangladesh, techincal sub-committee and drug control committee (DCC), National Drug Advisory Council.

Recommended Books:

1. The Pharmacy Ordinance, 1976, Ministry of Law and Parliamentary affairs, Government of Bangladesh, Dhaka
2. The Drugs (control) Ordinance, 1982, Ministry of Law and Land Reforms Government of Bangladesh, Dhaka.
3. Drug Policy of Bangladesh, Ministry of Health and Population Control, Health Division, Dhaka.
4. A Textbook of Forensic Pharmacy-B.M. Mithal
5. Pharmacist’s Code of Ethics, Pharmacy Council of Bangladesh

Pharm 441 Pharmaceutical Technology-III Credit 3

1. **Controlled and sustained release drug delivery systems**: Principle of SR dosage forms, drug properties and routes of administration, comparison between SR and CR dosage form, advantages and limitations of SR dosage forms, polymers used in SR and CR dosage form, classification and types of SR dosage forms, pharmacokinetic and pharmacodynamic basis of CR, bioavailability assessment, novel chemical approaches for SR drug delivery, drug release mechanisms from SR dosage forms, formulation and manufacturing of SR matrix tablets, dose calculation for SR dosage forms.
2. **Design and operation of clean rooms**: Source of contamination, classification of clean rooms, airflow systems- conventional flow, unidirectional flow, laminar airflow units; air filtration mechanisms, fibrous filters and HEPA filters, temperature and humidity control, building design, construction and use, personnel, protective clothing, cleaning and disinfection, commissioning tests of clean and aseptic rooms, routine monitoring tests, the operation of clean and aseptic rooms, key factors in clean room operations.
3. **Parenteral products**: Definition and classification of parenteral products, formulation considerations, vehicles and additives, containers, cleaning of container and closure, manufacturing techniques, raw materials and machines, quality control of parenteral products, sterilization of equipment, compounding of products, filtration of solution, filling and sealing procedures, environmental control and personnel.
4. **Ophthalmic products**: Anatomy of eye and retina, absorption of drugs in the eye, classification of ophthalmic products, safety considerations of ophthalmic products, formulation, vehicles and additives, manufacturing considerations, environment, manufacturing techniques, quality control of ophthalmic products, packaging of ophthalmic products.
5. **Aerosol science and technology**: Definition and classification of aerosol, propellers for aerosol manufacturing, components of aerosol formulation, containers and valves for aerosols, metered dose delivery of aerosols, manufacturing of aerosols, testing and quality assurance of aerosols.

Recommended Books:

1. The Theory and practice of Industrial Pharmacy- Leon Lachmann, Herbert A, Liuberman, Joseph L. Kanig
2. Sprowi's American Pharmacy- Lewis W. Dittert.
3. Pharmaceutics: The Science of Dosage Form Design- Michael Aulton.
4. Remington's The Science and Practice of Pharmacy –Alfronso R. Gennaro.
5. Controlled Drug Delivery: Fundamentals and Applications- J.R. Robinson and V.H.L. Lee
6. Dispensing for Pharmaceutical Students- Cooper and Gunn.
7. Dispensing of Medication-Husa and Martin.
8. Bentley's Textbook of Pharmaceutics- E.A. Rawlings
9. Tutorial Pharmacy- Aulton.
10. An introduction to Pharmaceutical Formulations- Fishburn.
11. Cooper and Gunn 's Tutorial Pharmacy-S.J. Carter
12. Hand book of pharmaceutical excipients – Arthur H. Kibbe

Pharm 442 Pharmaceutical Technology-III Lab Credit 1

Preparation, problems encountered during preparation, physical evaluation of different dosage forms (beats, film coating of tablets, parenteral products, ophthalmic preparations, sustained release products.)

Pharm 447 Advanced Pharmaceutical Analysis Credit 3

1. **Visible-ultraviolet and infrared spectrophotometry**: Introduction, electromagnetic radiation, units, electromagnetic spectra and absorption of radiation, Lambert's and Beer's law, deviations from Lambert-Beer law, instrumentation, colorimetry, chromophores and toposide, analysis of mixtures, absorption and intensity shifts, applications of ultraviolet and visible spectroscopy in quantitative analysis of drugs. Ultra violet and infrared spectroscopy in structural analysis.
2. **Nuclear magnetic resonance spectroscopy**: ^{1}H NMR spectroscopy: Introduction and theory, relaxation process, instrumentation, chemical shift, spin-spin coupling, different spin systems, coupling constants, spin-spin decoupling, long range coupling; Two dimensional NMR spectroscopy, nuclear over hauser effect, 2D correlated spectroscopy (COSY) and 2D Nuclear over hauser enhancement spectroscopy (NOESY), HMBC, HMQC. 13C NMR spectroscopy: Introduction, principle, chemical shift, spin-spin coupling, applications.
3. **Mass spectroscopy**: Introduction, theory, the mass spectrum, determination of molecular formula, ionization technique, recognition of molecular ion, fragmentation process, application.
4. **Atomic absorption spectroscopy**: Theory, instrumentation and application in quantitative analysis.
5. **Other Analytical tools**: Short study of differential scanning calorimetry (DSC) and differential thermal analysis (DTA), Near infrared detectors (NIR) and their applications in different areas.

Recommended Books:

1. Organic Spectroscopy- Philip Crews, Jamine Rodriguez and Marcel Jaspurs
2. Organic Sturcturefor Spectra- L.D. Field, S. Sternhell, J.R. Kaiman
3. Introduction to Spectroscopy-Donald L. Pavia, Gary M. Lampman, George S. Kriz
4. Interpretation of NMR Spectra: An Empirical Approach - Roy H. Bible.
5. One and Two Dimensional NMR Spectroscopy-Alta-UV Rahman,
6. Introduction to mass Spectroscopy- H.C. Hill.
7. Interpretation of Mass Spectra- Fred W. Mclafferly

Pharm 449 Pharmaceutical Engineering-II Credit 3

1. **Cooling and Refrigeration**.
2. **Air conditioning, humidification and dehumidification**.
3. **Evaporation and distillation**.
4. **Water purification engineering**: Types of water, impurities in water, water softening and purification for potable water, production and generation of purified water (PW), production of water for injection (WFI), techniques used in water purification, such as, deionization, electro deionization (EDI), distillation, reverse osmosis, water storage and distribution systems for pharmaceutical plant, loop system, piping components and types.
5. **Sterilization**: a) Efficiency of sterilization, designing the sterilization process, rate of biocidal action, initial contamination level, sterility assurance, determination of sterilizing conditions, testing the sterilization process. b) Important engineering features of heat sterilizers,testing and validation of different sterilization process, including dry heat sterilizers, autoclaves, sterilization by filtration and gas sterilization.
6. **Validation of process equipments and utilities**.
7. **Process analytical technology (PAT)**: Introduction, guidance, development, process and scope, background, PAT framework, process understanding, PAT tools, risk based approach, integrated system approach, real time release, strategy for implementation, PAT regulatory approach, comparison between conventional approach and PAT based approach in the tablet production, PAT in API production.
8. **Establishment of a pharmaceutical industry**: Pharmaceutical industry, plant location, plant layout, utilities and services, industrial pollution and control, industrial hazards and safety.

Recommended Books:

1. Pharmaceutical Engineering- K. Sambamurthy.
2. Pharmaceutical Engineering- C.V.S. Subrahmauyan.
3. Perry's chemical Engineering Handbook- Robert H. Perry.
4. The Theory and practice of Industrial Pharmacy- Leon Lachmann, Herbert A, Liuberman, Joseph L. Kanig
5. Sprowi's American Pharmacy- Lewis W. Dittert.
6. Pharmaceutics: The Science of Dosage Form Design- Michael Aulton.

Pharm 461 Pharmacology-III Credit 3

1. **Antiepileptic drugs**- Phenytoin, primidone, phenobarbitone, mephobarbitone, carbamazepine, valproic acid, lamotrigine, vegabatrin, benzodiazepines, trimathadone, gabapentin, types of seizures.
2. **Immunosuppressive agents and gene therapy**-Cytotoxic drugs, glucocorticoids, antibodies, specific T-cell inhibitors, gene modification, gene transfer, application.

3. **Antiviral drugs**: Anti-herpes virus, antiretrovirus, anti-influenza virus, nonselective.
4. **Antineoplastic drugs**: Alkylating agents, antimetabolites, vinca alkaloids, taxanes antibiotics, cisplatin, carboplatin, etoposide.
5. **Psychotropic and antidepressant drugs**.
6. **Drugs affecting uterine contraction**-Oxytocin, prostaglandin, ergot alkaloid.
7. **Cholinergic and anticholinergic drugs**.
8. **Adrenergic and antiadrenergic drugs**.
9. **Hormone therapy**- adenohypophyseal and adrenocorticosteroid hormone.
10. **Ophthalmology**- Anatomical consideration, corneal grafting, cataract formation, contact lens, drugs used in the treatment of eye disorders.
11. **Drugs metabolism**: Pathways of drugs metabolism, metabolism of various groups of drugs, factors affecting drugs metabolism, methods of studying drug metabolism, new aspect of drug metabolism, metabolic products of common drugs.

Recommended Books:

1. Goodman and Gillman's Pharmacological Basis of Therapeutics- Hardman, Joel G. McGraw Hill Incorporated.
2. Basic and Clinical Pharmacology- Bertram G. Katzung, Me Graw Hill Companies.
3. Medical Pharmacology-Andres Goth, Toppan Co. Ltd.
4. Pharmacology and Pharmacotherapeutics- R. S. Satosker, Paperback, Popular Prakashani Ltd. India.
5. Clinical Pharmacology- D, R. Laurence, P. N. Bennett and M. J. Brown, Churchill Living stone.
6. Clinical Pharmacy and Therapeutics - Roger walker and Clive Edwards, Churchill Living stone.

ORE 401 Oral Examination (Semester - 7) Credit 1

FOURTH YEAR, SECOND SEMESTER

Pharm 445 Cosmetology Credit 3

1. **The Skin**: Introduction, epidermis and keratinizing system, pigment system, dermis, nerves

and sense organs, blood vessels, exocrine sweat glands, hair follicles, sebaceous glands, apocrine glands, common disorders of the skin.

2. **Product ingredients**: Commonly used surface-active agents, humectants, antiseptics, preservatives, antioxidants.
3. **The manufacture of cosmetics**: Introduction, mixing and the manufacture of bulk cosmetic products, solid-solid mixing, manufacture of pigmented powder products, mixing processes involving fluids, general principles of fluid mixing, mixing equipments for fluids, solid-liquid mixing, suspension of solids in agitated tanks, liquid-liquid mixing- miscible liquid, immiscible liquid.
4. **Skin Creams**: Introduction, classification of skin creams, cold creams, cleansing creams, night and massage creams, moisturizing, vanishing and foundation creams, pigmented foundation creams, hand creams and hand-and-body creams, all purpose creams.
5. **Shaving preparations**: Introduction, lather shaving cream, brush less or non-lathering cream, aerosol shaving foams, after-shave preparations.
6. **Dental products**: Introduction, formulation and manufacturing of toothpastes and tooth powders, mouth wash.
7. **Hair products**: Introduction, shampoos, hair setting lotions, hair tonics and conditioners.

Recommended Books:

1. Hand book of cosmetics- B.M. Mithal.
2. Modern cosmetics-Perfumes, cosmetics and soap- vol III. George M. Howard.
3. Text book of cosmetics- M. Vimaladevi.
4. Cosmetics – M.S. Balsam.
5. Harry's Cosmetology- J. B. Wilkinson and R. J. Moore, Longman.

Pharm 446 Cosmetology Lab Credit 1

Formulation, preparation and evaluation of cold cream, vanishing cream, transparent shampoo, egg shampoo, talcum powder, tooth powder, and shaving cream and after shave lotion.

Pharm 453 Pharmaceutical Biotechnology Credit 3

1. **Introduction to Biotechnology**: History of biotechnology, modern definition, technologies included biotechnology: Fermentation, cell and tissue culture, genetic engineering, antisense technology, monoclonal antibody technology, biosensor technology, DNA finger-printing and diagnostic technique, biodegradation etc. Impact of biotechnology on pharmaceutical industry.
2. **Genetic engineering**:

   a) r-DNA: r-DNA, steps involved in the production of r-DNA.

   b) Tools of genetic engineering: Enzymes, cloning vectors, c-DNA library, genomic library.

c) DNA Transfer: Methods of DNA transfer.

d) Gene cloning: Steps involved in gene cloning.

e) Animal cloning: Transgenic animal, steps involved in animal cloning.

f) PCR: Components of PCR, steps involved in PCR, application of PCR, advantages and disadvantages of PCR.

g) Gene Therapy: Ex vivo versus in vivo gene therapy, potential target diseases for gene therapy, gene transfer methods, and non-viral gene transfer.

3. **Hybridoma technology**: Antibody, structure of antibody, types of antibody, antigen, epitop, monoclonal antibody, application of monoclonal antibody, steps involved in the production of monoclonal antibody.

4. **Fermentation technology**: Fermentation, fermenters, bioreactors, production of antibiotics, production of vitamins.

5. **Biotech pharmaceuticals**: Anticoagulants, colony stimulating factors, erythropoietin, interferon, interleukins, monoclonal antibody, peptides, vaccines etc.

6. **Designing of drug delivery systems for biotech. products**:Stability aspects, methods of improving stability, consideration of route of administration: Oral route, methods to improve oral bioavailability, parenteral route, Parenteral drug delivery systems (soluble carrier system, particulate carrier system, liposomes, microspheres, nanoparticles, microemulsion etc.), trandermal route (Iontophoresis, phonophoresis etc.), nasal route, rectal route, trans mucosal route etc.

7. **Dispensing of biotechnology products**: Temperature requirements, storage in dosing and administration devices, light protection, handling, missing and shaking, travel requirement, preparation and administration.

Recommended Books:

1. Pharmaceutical Biotechnology An introduction for pharmacists and pharmaceutical scientists - D. Crommelin and D. Sindelar.
2. Pharmaceutical Biotechnology- Vyas.
3. Principle of Biochemistry- Lehlinger.
4. Human Molecular Genetics- Tomstrachan.

Pharm 455 Hospital, Community and Clinical Pharmacy Credit 3

1. **Hospital Pharmacy**: A comprehensive knowledge of hospital pharmacy, control of special classes of drugs, floor stock drug, hospital pharmacist in educational and training programs, health education and public health

2. **Community Pharmacy**: a) Definition and scope of community pharmacy, b) Organization inventory control and management of retail pharmacy business, c) Communication, counseling for patient compliance, d) Role of pharmacist in community health care and education
3. **Clinical Pharmacy**: a) Introduction to clinical pharmacy, b) Basic concepts of pharmacotherapy: i. Clinical pharmacokinetics and individualization of dosage regimen, ii. Drug induced diseases, iii. Adverse drug interaction, iv Clinical toxicology, c) Interpretation of common clinical laboratory tests, d) Pathophysiology and Therapeutics: i. Fluid and electrolyte disorders and shock, ii. Infectious diseases, iii. Cardio-vascular diseases, iv. Kidney and urinary tract disorders, v. Nervous system disorders, vi. Endocrine and reproductive disorders, e) Drug information

Recommended Books:

1. Hospital Pharmacy- William E. Hasan, Lea and Febiger, Philadelphia.
2. Textbook of Hospital Pharmacy- M. C. Allwood, J. T. Fell, Blackwell Scientific Publications, Oxford
3. Clinical Pharmacy and Therapeutics - Herfindel
4. Principle of Clinical Pharmacology- Atkinson.
5. Workbook for Clinical Pharmacy and Therapeutics- Hart.
6. Handbook of Clinical Research- Lloyd.
7. Clinical Pharmacy and Therapeutics- Walker.

Pharm 457 Pharmaceutical Packaging Technology Credit 3

1. **Introduction**
2. **Packaging Materials for pharmaceutical product:** Properties of packaging materials, glass and glass containers, (vials, ampoules, glass bottles for non-sterile products) metal and metal containers, plastic and plastic containers, films, foils and laminates, rubber-based materials, aluminium tubes for ointments, advantages and disadvantages of different packaging materials.
3. **Closures for pharmaceutical packaging**: Tamper resistant packaging and child resistant packaging, Desiccants used in pharmaceutical packaging, Different packaging machines and accessories: Blister packing machine, sachet packing machine, strip packaging machine, Testing and quality assurance of packaging materials.

Recommended Books:

1. The Theory and practice of Industrial Pharmacy- Leon Lachmann, Herbert A, Lieberman, Joseph L. Kanig.
2. Sprowi's American Pharmacy- Lewis W. Dittert.
3. Pharmaceutics: The Science of Dosage Form Design- Michael Aulton.
4. Remington's The Science and Practice of Pharmacy –Alfronso R. Gennaro.

5. Novel Drug Delivery Systems- Yie W. Chien.
6. Moern Pharmaceutics-Gilgert S. Banker and Christopher T. Rhodes.

Pharm 458 Pharmaceutical Packaging Technology- Lab Credit 1

1. Testing of alumimium foil.
2. Leak test of tablet blister, strip, sachet and alu-alu blisters.
3. Leak test for ampoules.

Pharm 409 Project Credit 3

ORE 402 Oral Examination (Semester - 8) Credit 1