

# **Bachelor of Pharmacy (Honours)**

Offered by

**Department of Pharmacy**

Under

Faculty of Science and Engineering



**International Islamic University Chittagong (IIUC)**

(Updated- March 20, 2010)

**Bachelor of Pharmacy (Honours)**  
*(4 Years Honours Course consists of 8 Semesters)*

## **1. Objectives**

- i) 4 years Bachelor of Pharmacy (Honours) program aims to provide in depth education in Pharmacy and relevant subjects. This program aims in-
  - Developing students with a wide range of pharmacy relevant education and their application in practice.
  - Preparing students to accept the challenges of twenty first century in the field of pharmaceutical breakthrough.
  - Getting students trained to be competent for the job market of wide range of pharmaceutical fields.
- ii) Students shall have wide range of options to begin their professional career after earning their 4 years Bachelor of Pharmacy (Honours) degree. Options are-,
  - Work for pharmaceutical companies as production pharmacist, research & development pharmacist, quality control analyst, quality assurance personnel and other relevant administrative officials.
  - Work for hospital & clinic as a hospital & clinical pharmacist
  - Work for government in different health care, hygiene and Immunization programs.
  - Work for corporate bodies of varied nature, especially in pharmaceutical marketing.
- iii) Students shall be encouraged in undergoing the study of pharmacy in a congenial atmosphere with state of the art laboratories. They shall be trained to be keen and analytical, concerning the contradictions and consistencies in theory and practice of pharmacy.
- iv) There shall be both theory and practical examinations at the end of semesters for all the subjects. Class tests, assignments etc. carried out during the semester shall also be considered in making overall assessment. A satisfactory class record will also be required at each stage.

## **2. Eligibility of students for admission**

The prerequisite is two second divisions respectively in SSC and HSC (or grade C equivalent to GPA 2.5-2.9 individually) can apply for the admission. Student having 5 subjects in 0 level (of GCE/ GCSE/ IGCSE) and 2 major subjects in A Level with minimum C grade in each or equivalent US high school diploma may also apply. Department may directly collect the students with two first divisions respectively in SSC and HSC (or grade A<sup>+</sup>) equivalent to 3.5-3.9 or total GPA

6.5 or above in SSC and HSC of which any one has no less than 3.0 with all pass in the subjects.

If the process of direct intake does not fulfill the seats in pharmacy, then though a process of admission test we can take rest of the students to fill up the seats. Test would be given on HSC level syllabus of chemistry, biology, English and general knowledge. A candidate must possess least 40% marks in the admission test to be considered for admission.

Students shall have any one of the following two combinations for the subjects:

- i. Chemistry, Physics and Biology
- ii. Chemistry, Physics and Mathematics (with Biology as an optional subject)

### 3. Academic Calendar

An academic year will consist of two semesters of 6 months duration each. Semesters shall be divided in the following manner.

<u>Semester:</u>	<u>Duration:</u>
Spring	February - July
Autumn	August - January

### 4. Grading/Assessment System (Letter Grade & CGPA)

IIUC follows the grading system for evaluating the academic performance of the students as introduced by the UGC to implement in the all public and private universities:

Numerical Grade	Letter Grade	Grade Point
80% - 100%	A+	4.00
75% - 79%	A	3.75
70% - 74%	A-	3.50
65%-69%	B+	3.25
60% - 64%	B	3.00
55% - 59%	B-	2.75
50% - 54%	C+	2.50
45% - 49%	C	2.25
40% - 44%	D	2.00
00 – 39%	F	0.00

### 5. Assessment Procedure

There shall be assessment based on class attendance, class tests, assignments and semester ending examinations. Number of class tests and assignments shall depend on respective course teacher.

**Distribution of % marks:**

Class attendance/Test/Assignments	20%
Mid Term Examination	30%
Semester Final Examination	50%

**6. Credit Hour per Course**

International Islamic University Chittagong (IIUC) follows the Credit Hour System in its academic programs of having involvement of 18 weeks of instruction in each semester. Courses may have different credit hours depending on the course length and weight in the curriculum.

A pharmacy theory course of 3 credit hours comprise 42 hours (3 credits x 14 hours) of instruction. Thus every week there will be 3 theory classes and this is covered within a number of 42 theory classes (each class has duration of 1 hour.)

A pharmacy practical course of 1 credit hour means 1 practical classes (each of practical class has duration of 3 hours (except Computer and Statistics) per week.

**7. Graduation**

To obtain the Bachelor of Pharmacy, a student shall have to complete a minimum of 163 Credit Hours with a minimum CGPA of 2.00. If any student fails in any course he will get the opportunity to improve the grade by re-taking the same in the subsequent semester along with regular students.

**8. Examination**

Students will appear in the examination at the end of each of the semester. Examination covers both theory and practical as mentioned in the curriculum. Assessment will be made in each semester on the basis of total marks obtained in class records, mid term and semester final examination.

**Examination system**

1. Questions for each course will be set by two teachers– course teacher & another one (both from the department).
2. The external member of examination committee will be question setter of a course related to him.
3. The moderation board (examination committee) will moderate the questions giving priority to the question of course teacher.
4. Respective question setter will do the answer scripts' marking.
5. Average of two examiners' marks will be the marks obtained by examinee.
6. If difference between two marks becomes more than 15% third examination will be done. Average of two nearer marks will be mark obtained by the examinee.
7. Answer script should be returned within 5 days of receipt. Taka 10/= per day will be deducted from the remuneration for delay.
8. Examination committee will select tabulators.

## 9. Promotion

A student who requires spending a period of time away from the university may apply by filling up a prescribed form (available at ACAD) of semester drop for a leave of absence stating valid ground for the purpose and length of leave desired (maximum two semesters). The student must apply for dropping the semester during the registration period.

## 10. Practical Training

Every student of B. Pharm. (Hon's.) shall be required to undergo In-plant training of four (4) weeks at the end of his 8<sup>th</sup> semester of study in a pharmaceutical industry arranged by the authority.

Students shall keep a record of all the work done during their practical training and a report to be submitted to the respective department as well as respective pharmaceuticals countersigned by the In-charge teacher and official of the pharmaceutical industry.

## 11. Project

Every student of B. Pharm. (Hon's) has to submit a dissertation on a selected topic having importance in pharmacy at the end of 8<sup>th</sup> semester.

## 12. Semester wise break up of courses. Total Credit Hours: (150+13) = 163

### 1<sup>st</sup> Semester

Sl.#	Course No.	Course Name	Credits	Prerequisite
1.	URIS-1101	Islamic Aqidah	1	None
2.	URAL-1101	Elementary Arabic	1	None
3.	UREL-1103	Advanced English	2	None
4.	Pharm-1101	Cell Biology & Anatomy	3	None
5.	Pharm-1103	Organic Pharmacy-I	3	None
6.	Pharm-1104	Organic Pharmacy-I Lab	1	None
7.	Pharm-1105	Physical Pharmacy-I	3	None
8.	Pharm-1106	Physical Pharmacy-I Lab	1	None
9.	Pharm-1107	Mathematics & Biostatistics	3	None
10.	Pharm-1108	Mathematics & Biostatistics Lab	1	None
11.	Pharm-1109	Introduction to Computer	2	None
12.	Pharm-1110	Introduction to Computer Lab	1	None
	Total		22	

### 2<sup>nd</sup> Semester

Sl.#	Course No.	Course Name	Credits	Prerequisite
1.	URAL-1202	Intermediate Arabic	1	URAL-1101
2.	URIS-1203	Introduction to Ibadah	1	URIS-1101
3.	Pharm-1201	Inorganic Pharmacy –I	3	None
4.	Pharm-1202	Inorganic Pharmacy –I Lab	1	None
5.	Pharm-1203	Physical Pharmacy-II	4	Pharm-1105
6.	Pharm-1204	Physical Pharmacy-II Lab	1	Pharm-1106
7.	Pharm-1205	Pharmaceutical Microbiology& Immunology	4	None
8.	Pharm-1206	Pharmaceutical Microbiology & Immunology Lab	1	None
9.	Pharm-1207	Pharmacognosy & Phytochemistry-I	3	None
10.	Pharm-1208	Pharmacognosy & Phytochemistry-I Lab	1	None
11.	Pharm-1213	Oral Assessment-I	1	
	Total		21	

**3<sup>rd</sup> Semester**

Sl.#	Course No.	Course Name	Credits	Prerequisite
1.	URIS-2303	Introduction to Qur'an & Sunnah	1	URIS-1203
2.	Pharm-2301	Inorganic Pharmacy-II	3	Pharm-1201
3.	Pharm-2302	Inorganic Pharmacy-II Lab	1	Pharm-1202
4.	Pharm-2303	Organic Pharmacy-II	3	Pharm-1103
5.	Pharm-2304	Organic Pharmacy-II Lab	1	Pharm-1104
6.	Pharm-2305	Pharmacognosy & Phytochemistry-II	3	Pharm-1207
7.	Pharm-2306	Pharmacognosy & Phytochemistry-II Lab	1	Pharm-1208
8.	Pharm-2307	Biomolecular Pharmacy & Biotechnology-I	3	None
9.	Pharm-2308	Biomolecular Pharmacy & Biotechnology-I Lab	1	None
10.	Pharm-2309	Human Physiology-I	4	None
11.	Pharm-2310	Human Physiology-I Lab	1	None
	Total		22	

**4<sup>th</sup> Semester**

Sl.#	Course No.	Course Name	Credits	Prerequisite
1.	URIS-2405	Dealings and Behaviors in Islam	1	URIS-2303
2.	Pharm-2401	Human Physiology-II	4	Pharm- 2309
3.	Pharm-2402	Human Physiology-II Lab	1	Pharm- 2310
4.	Pharm-2403	Pharmaceutical technology-I	3	None
5.	Pharm-2404	Pharmaceutical technology-I Lab	1	None
6.	Pharm-2405	Pharmacology-I	4	None
7.	Pharm-2406	Pharmacology-I Lab	1	None
8.	Pharm-2407	Biomolecular Pharmacy and Biotechnology-II	3	Pharm-2307
9.	Pharm-2408	Biomolecular Pharmacy and Biotechnology-II Lab	1	Pharm-2308
10.	Pharm-2413	Oral Assessment-II	1	
	Total		20	

**5<sup>th</sup> Semester**

Sl.#	Course No.	Course Name	Credits	Prerequisite
1.	URIS-3505	Government and Politics in Islam	1	URIS-2303
2.	Pharm-3501	Pharmaceutical Technology-II	2	Pharm-2403
3.	Pharm-3502	Pharmaceutical Technology-II Lab	1	Pharm-2404
4.	Pharm-3503	Pharmacology-II	4	Pharm-2405
5.	Pharm-3504	Pharmacology-II Lab	1	Pharm-2406
6.	Pharm-3505	Biopharmaceutics & Pharmacokinetics-I	3	None
7.	Pharm-3506	Biopharmaceutics & Pharmacokinetics-I Lab	1	None
8.	Pharm-3507	Medicinal Chemistry-I	4	None
9.	Pharm-3509	Pharmaceutical Analysis-I	3	None
10.	Pharm-3510	Pharmaceutical Analysis-I Lab	1	None
	Total		21	

**6<sup>th</sup> Semester**

Sl.#	Course No.	Course Name	Credits	Prerequisite
1.	URIH-3609	Biography of the prophet (SAW)	1	URIS-3505
2.	Pharm-3601	Medicinal Chemistry-II	3	Pharm-3507
3.	Pharm-3602	Medicinal Chemistry-II Lab	1	None
4.	Pharm-3603	Biopharmaceutics & Pharmacokinetics-II	3	Pharm-3505
5.	Pharm-3604	Biopharmaceutics & Pharmacokinetics-II Lab	1	Pharm-3506
6.	Pharm-3605	Pharmaceutical Analysis-II	3	Pharm-3509
7.	Pharm-3606	Pharmaceutical Analysis-II Lab	1	Pharm-3510
8.	Pharm-3607	Pharmaceutical Engineering-I	3	None
9.	Pharm-3608	Pharmaceutical Engineering-I Lab	1	None
10.	Pharm-3609	Pharmaceutical Regulatory Affairs	3	None
11.	Pharm-3613	Oral Assessment-III	1	
	Total		21	

**7<sup>th</sup> Semester**

Sl.#	Course No.	Course Name	Credits	Prerequisite
1.	URIH-4701	A Survey of Islamic History	1	URIS-3609
2.	Pharm-4701	Pharmaceutical Engineering-II	3	Pharm-3607
3	Pharm-4702	Pharmaceutical Engineering-II Lab	1	Pharm-3608
4.	Pharm-4703	Medicinal Chemistry-III	3	Pharm-3601
5	Pharm-4704	Medicinal Chemistry-III Lab	1	Pharm-3602
6.	Pharm-4705	Clinical Pharmacy	3	None
7	Pharm-4706	Clinical Pharmacy Lab	1	None
8.	Pharm-4707	Pharmaceutical Marketing & Management	3	None
9.	Pharm-4709	Pharmaceutical Quality Assurance	3	None
	Total		19	

**8<sup>th</sup> Semester**

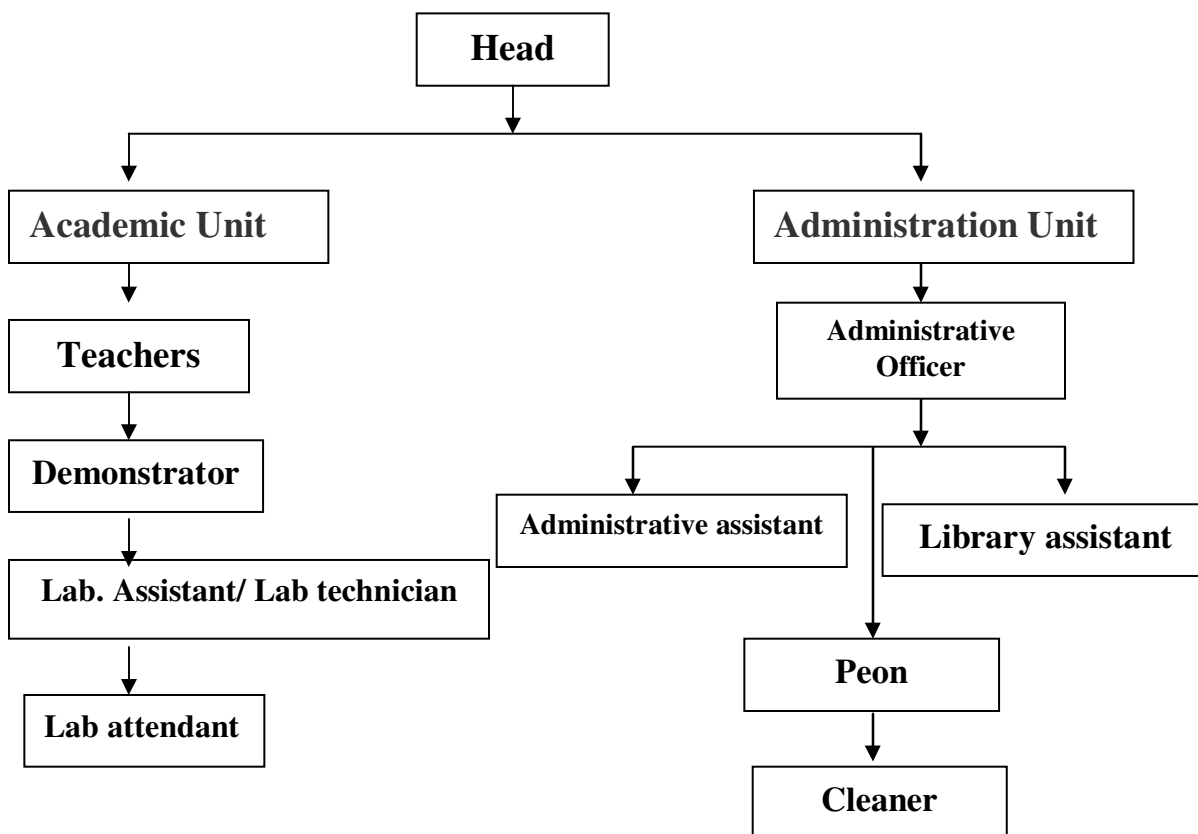
Sl.#	Course No.	Course Name	Credits	Prerequisite
1.	URBS-4802	Bangladesh Studies	2	None
2	Pharm-4801	Biopharmaceutics & Pharmacokinetics-III	3	Pharm-3603
3.	Pharm-4802	Biopharmaceutics & Pharmacokinetics-III Lab	1	Pharm-3604
4.	Pharm-4803	Hospital & Community Pharmacy	3	None
5.	Pharm-4805	Toxicology	2	None
6	Pharm-4807	Cosmetology	2	None
7.	Pharm-4808	Cosmetology Lab	1	None
8.	Pharm-4809	Practical Training (In Plant Training)	0	None
9	Pharm-4813	Oral Assessment-IV	1	
10	Pharm-4814	Project	2	None
	Total		17	

**13. Laboratory facilities:**

The practical classes and examinations of 12 lab courses are arranged among four laboratories as follows.

1. Lab-I: Organic, Medicinal and Biomolecular Pharmacy Lab.
2. Lab-II: Inorganic, Physical and Analytical Pharmacy Lab.
3. Lab-III: Physiology, Pharmacology and Microbiology Lab.
4. Lab-IV: Pharmacognosy, Pharmaceutics and Biopharmaceutics Lab.

#### 14. Proposed Organogram:



#### 16. Manpower Requirements:

Position	Required	Present	Up gradation Due	Deficit
Professor	02	02	--	0
Associate Professor	02	01	--	01
Assistant Professor	04	01	--	03
Lecturer	04	02	--	02
Demonstrator	03	00	--	03
Lab Technician	03	01	--	02
Lab. Attendant	04	02	--	01
Administrative officer	01	00	--	01
Administrative Assistant	02	01	--	01
Peon	04	01	--	03
Cleaner	02	01	--	01

## Course Curriculum

### 1st Semester

#### **URIS-1101: Islamic Aqidah**

Credit Hour: 1

Contact Hours: 1 per week

To introduce correct islamic aqidah and rectification of traditional misconcepts as to aqidah, special emphasis on tawhid, risalat, akhirat and serious consequences of shirk and nifaq.

1. **Islam:** Introduction: a) Meaning of Islam b) Historical background of Islam c) Islam as a complete code of life, d) Importance of islamic aqidah and relation between iman and islam.
2. **The Articles of Faith:** a) Unity of Allah (tawheed) b) Impact of tawheed on human life, c) The shirk and its consequences d) Different types of shirks e) Nifaq: Its meaning, signs and consequences.
3. **Belief in Allah's Angels (Malaikah):** a) Angels, their nature and their functions b) Virtues of belief on angels.
4. **Belief in the books of Allah:** a) TheQur'an: The last and unchanged divine book.
5. **Belief in Allah's Prophet (SAW):** a) Prophets and Messengers are human being, b) Mohammad (SAW) the greatest, the best and last among all the prophets, c) Duties and the responsibilities of the prophets d) Love of the prophets.
6. **Belief in the life after the death:** a) Impact of belief in the life after the death on human life b) Inevitability of akhirat and its stages.
7. **Belief in Qadr (Fate) and Divine decree:** a) Man's freedom of will b) Fate: no excuse for sinners c) Evil: not attributable to Allah.

#### **Recommended Books:**

1. Syed Mahmudul Hasan - ISLAM
2. Prof. Dr. Abu Bakr Rafique -Islamic Aqidah
3. Md. Shafiul Alam Bhuiyan -Arkanul Iman
4. Prof. Dr. Abu Bakr Rafique- Islam the Ultimate Religion
5. Farid Ahmad- An Encounter with Islam
6. Abdalati, Hammada- Islam In Focus, Islamic Teaching Course
7. Badawi, Dr. Jamal- Islamic Teaching
8. Ghulam Sarwar- Islam Belief and Teachings.

#### **URAL-1101: Elementary Arabic**

Credit Hour: 1

Contact Hour: 1 per week

This course has been provided to the students for basic knowledge of Arabic scripts, how to write scripts in words and arabic writing. It also aims to provide about 500 normal using words in order to develop sentence construction as well as they will be able to

communicate with others orally in various situations. Generally there are two main areas of concentration:

Firstly, the course aims at helping the student to acquire the level of proficiency that will enable them understand the texts and content of Al-Qur'an and Sunnah of prophet (SAW) from the original arabic text. Secondly, to enable the student acquire the skills of understanding the arabic lecture. Taking notes and proficiency in writing answer script in Arabic language, and using the original sources written in the arabic language and with the course to help the students acquire the proficiency with competence on communication in arabic which is widely used within muslim ummah particularly.

### **Recommended Books:**

1. Dr. F. Abdur Rahim : Arabic Teaching for Non-Arabic
2. Dr. Fuad Abdur Rahman- Durusul Lugatil Arabia li Gairinnatigeena Biha
3. King Saud University – Al Arabia Al Mayassarah (Easy Arabic)
4. King Saud University - Al- Arabiatu Lil Hayal (Arabic for daily life).

### **UREL-1103: Advanced English**

Credit Hours: 2

Contact Hours: 3 per week

1. **Grammar Review** : Tense and their aspects, subject-verb agreement, affirmative agreement, negative agreement, modal auxiliaries, modals + perfective, conditional sentences, active and passive voice, preposition, causative verbs, participle & gerund, conjunction.
2. **Reading** : Pride and Prejudice, The great Gatsby, Jane Eyre and A Tale of two Cities.
3. **Writing** : Paragraph, Comprehension and Dialogue.

### **Recommended Books:**

- |                                     |   |
|-------------------------------------|---|
| 1. Wishon, G.E and Burks, J.M.      | : Let's Write English                         |
| 2. Wren & Martin                    | : High School English Grammar and Composition |
| 3. Murphy                           | : Intermediate English                        |
| 4. Maurice Imhoof and Herman Hudson | : From Paragraph to Essay                     |
| 5. Jupp and Milne                   | : Guided Course in English Composition        |
| 6. Houghton Mifflin English         | : Grammar and Composition                     |
| 7. Longhead, Lin                    | : Business Correspondence                     |

### **Pharm- 1101: Cell Biology & Anatomy**

Credit Hours: 3

Contact Hours: 3 per week

1. **Cell and Tissue** : Structure and functions, cell inclusion, division of cell.  
Tissue: Definition and classification. epithelial tissue, connective tissue, muscle tissue, blood. bone & cartilage, nerve tissue, functions of various tissues & their minute structure.

2. **GIT** :Parts of GIT and their associated organs like liver, spleen, and pancreas.
3. **Urinary System:** Kidney (structure).
4. **Heart and circulation:** Anatomical structure of heart, its circulatory system, origin, transmission and control of heart beat.
5. **Respiratory System:** Anatomy of lung, cardiac dullness, alveoli, functions of lungs.
6. **Endocrine glands:** Structure of thyroid, parathyroid, suprarenal glands.
7. **Reproductive system:**
  - a. Anatomy of male and female reproductive system.
  - b. Structure of tests, ovary, uterus & placenta.

### **Recommended Books:**

1. Zunqueira : Basic Histology
2. Grays- Anatomy
3. Bailey,s- Histology
4. B D Chowrashia : Human Anatomy vol. I,II,III
5. Selim Reza- Essentials of Gross Anatomy and Histology.
6. Crouch- Human Anatomy
7. Basmajian- Primary Anatomy
8. Miller- Anatomy and Physiology
9. Robertis- Cell and Molecular Biology

### **Pharm-1103: Organic Pharmacy-I :**

Credit Hours: 3

Contact Hours: 4 per week

1. **Introduction to organic chemistry:** Saturated and unsaturated hydrocarbon etc.
2. **Alkanes, alkenes and alkynes:** Introduction, methods of preparation, physical and chemical properties and pharmaceutical applications.
3. **Aldehydes and ketones:** Introduction, methods of preparation, physical and chemical properties and pharmaceutical applications.
4. **Alcohols, ethers, epoxides:** Introduction, methods of preparation, physical and chemical properties and pharmaceutical applications.
5. **Carboxylic acids:** Introduction, methods of preparation, physical and chemical properties and pharmaceutical applications.
6. **Amines:** Introduction, methods of preparation, physical and chemical properties and pharmaceutical applications.

### **Recommended Books:**

1. Morrison, Boyd - Organic Chemistry
2. B H Bahl and Bahl - Advance Organic Chemistry.
3. I L Finar - Organic Chemistry
4. Fox- Organic Chemistry
5. Synder- Modern Organic Chemistry
6. Sing, Kapoor- Organic Pharmaceutical Chemistry
7. Nadendlar- Pharmaceutical Organic Chemistry

### **Pharm-1104 : Organic Pharmacy-I Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Identification of simple organic compounds.
2. Synthesis of simple compounds using name reactions.

### **Pharm-1105: Physical Pharmacy-I**

Credit Hours: 3

Contact Hours: 4 per week

1. **Properties of gases:** Gas laws, ideal gas equation, Dalton's law of partial pressure, diffusion of gases, kinetic theory of gases, mean free path, deviation from ideal gas behavior, van der Waals equation, critical constants, liquefaction of gases, determination of molecular weights, law of corresponding states and heat capacity.
2. **Chemical Equilibrium:** Law of mass action, determination of equilibrium constant, heterogeneous equilibrium and homogenous equilibrium, Le Chatelier principle and Vant Hoff equation.
3. **Phase equilibria:** Phase, components and degrees of freedom, phase rule and its thermodynamic derivation, phase diagrams of water and sulphur systems; partially miscible liquid pairs: the phenol and water and nicotine-water systems; completely miscible liquid pairs and their separation by fractional distillation, freeze drying (lyophilization).
4. **Solutions:** Types and properties of solutions, units of concentration, ideal and real solutions, Henry's law, distribution of solids between two immiscible liquids, distribution law, partition coefficient and solvent extraction.
5. **Colligative properties of dilute solutions:** Lowering of vapour pressure, elevation of boiling point, depression of freezing point and osmotic pressure including necessary thermodynamic derivations.
6. **Ionic Equilibria:** pH, determination of pH of different acids and bases, salt solutions and buffers, titration curves of acids and bases and indicators.
7. **Buffer capacity:** Preparation of buffers, buffers and isotonic systems, methods for adjustment of tonicity of solutions, buffers in pharmaceutical and biological systems.

### **Recommended Books:**

1. A Martin, P Bustamania, Chue- Physical Pharmacy

2. B S Bahl, G D Tuli - Essentials of Physical Chemistry
3. Haque, Nawab- Physical Chemistry
4. Lewis Glasston- Physical Chemistry
5. Barrow- Physical Chemistry
6. Castellon- Physical Chemistry
7. Paul, Chak- Physical Chemistry

### **Pharm-1106 : Physical Pharmacy-I Lab**

Credit Hour: 1

Contact Hours: 3 per week

1. Preparation of primary and secondary standard solution
2. Determination of strength of strong acid (HCl) with weak base ( $\text{Na}_2\text{CO}_3$ ).
3. Determination of strength of strong (NaOH) with primary standard (Oxalic acid)
4. Standardization of strong base (NaOH) with strong acid (HCl) solution.
5. Determination of integral heat of solution of ammonium chloride,  $\text{NH}_4\text{Cl}$ .
6. Standardization of sodium thiosulphate,  $\text{Na}_2\text{S}_2\text{O}_3$ .

### **Pharm-1107: Mathematics and Biostatistics**

Credit Hours: 3

Contact Hours: 4 per week

#### **Section A: Mathematics**

#### **1. Graphs and Gradients:**

- a) Rectangular co-ordinates, curve fitting using first degree equation in both variables, determination of slope and intercept and point of intersection, equation of first degree in both x and y (circle), ellipse, rectangular hyperbola etc.
- b) Exponential and logarithmic curves, graphical solution of equation, graphical solution of simultaneous equations
- c) Arithmetic progression, geometric progression, permutation-combination, binomial theorem, exponential theorem.
- d) Pharmaceutical application of curve fitting method in expressing degradation of drugs.

#### **2. Calculus:**

- a) Rate 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 curve, integration by partial fraction, graphical integration, indefinite and definite integrals.

#### **3. Matrices:**

Addition, subtraction and multiplication of matrices, unit matrix, row transformation, determinants, inverse of matrix and solution of equations by matrix.

## **Section B: Biostatistics**

1. **Introduction to Basic Statistics:** Definitions, graphs and diagrams and their theorems and problems.
2. **Measures of central tendency:** Arithmetic mean geometric mean, harmonic mean, median and mode and their theorems and problems.
3. **Measures of dispersion:** Range of mean deviation, variance, coefficient of variation, standard deviation and their theorems and problems.
4. **Correlation and Regression Analysis:** General notion of correlation, calculation of correlation coefficient, rank correlation coefficient and multiple correlations. basic idea of regression, calculation of regression coefficient, coefficient of determination, standard error and significance test, independent variables and their theorems and problems.

### **Recommended Books:**

1. Thomas, Finney- Calculus and Analytic Geometry
2. Shahidulla , Bhattacharjee - A text book on Coordinate Geometry and Vector Analysis
3. Seymour Lipschutz- Set Theory and Related Topics
4. Abu Yousouf- Differential Calculus
5. K. A. Stroud- Engineering Mathematics
6. R. Spigel- Mathematical Handbook of Formulas and Tables
7. Murry, R. Spigel and Robert Moyer- College Algebra
8. M G Mostafa - Methods of Statistics
9. Monindra Kr. Roy- Fundamental of Probability
10. Gupta- Introduction to Statistical Methods
11. Mia and Mian- Statistics

## **Pharm-1108 : Mathematics and Biostatistics Lab**

Credit Hour: 1

Contact Hours: **2 per week** (Only for Bio-Statistics)

1. **Introduction to Basic Statistics:** Concentration and tabulation of data, graphical representation of a frequency distribution (histogram, different frequency curves, dot frequency diagram, frequency polygon, cumulative frequency curve, bar diagram, pie chart, time chart etc).
2. **Measures of central tendency:** Calculation of various measures of locations by the usual formulas and graphical method and their comparison.

**3. Measures of dispersion:** Calculation of various measures of dispersion (range, mean deviation, quartile deviation, standard deviation and their coefficients, variance, coefficient of variation etc.) for grouped and ungrouped data.

**4. Correlation and Regression Analysis:** Construction of a scatter diagram, simple correlation coefficients, simple regressions, rank correlation coefficient, multiple correlation coefficients, multiple regression lines, coefficient of determination, relationship between simple and multiple correlation coefficient and coefficient of determination.

### **Pharm-1109: Introduction to Computer:**

Credit Hours: 2

Contact Hours: 4 per week

**1. Introduction of Computer and its Organization:** Historical evolution of computer & classification, computer generation, basic organization a functional unit of computer, central processing, microprocessor and micro controller.

**2. Number System:** Different number systems & their conversion, fractional numbers, numeric/alphanumeric data, BCD/ASCII code, binary arithmetic (addition, subtraction).

**3. I/O devices, logic gates:** Input and output devices, printers, keyboard, mouse, scanner, and other devices, basic concepts of logic gates, truth table, OR gate, AND gate XOR gate, NOR gate, universal gates.

**4. Memory:** Memory, RAM, ROM, cache memory, sequential /direct/random access device, magnetic tape and disk, hard disk, floppy disk, CDROM, optical disk.

**5. Operating System:** Basic concept of operating system, evolution of OS, function of operating system, batch system multiprogramming system, multiprocessing system, distributed system, time-sharing system, and real time system.

**6. Computer Program, Software and language:** Program planning: algorithms, flow charts, pseudocode, software and firmware types of computer software, types of computer language, translator, interpreter and compiler.

**7. Data communication and computer Network:** Basic elements of a communication system, types of communication among computers computer networks, OSI reference model, LAN, MAN, WAN, Network, topologies, Network connecting devices.

#### Recommended Books:

1. Dr. M. Lutfar Rahaman. -Computer Fundamentals
2. P.K. Sinha - Computer Fundamentals concepts, Systems and Applications
3. N. Subramanian - Introduction to Computer.
4. V. Rajarcman - Fundamentals of Computers
5. Peter Norton -Introduction to Computer
6. Satish Jain - Introduction to Computer

**Pharm-1110: Introduction to Computer: Lab**

Credit Hour: 1

Contact Hours: 2 per week

- 1. Operating System:** Proposed Operating Systems: Windows 2000/ XP, topics of windows: files, folders, basic operations on file/ folders, file system, windows OS organization and hierarchy, searching files and folders.
- 2. Word Processing:** Proposed application software: Microsoft word topics: formatting tables, editing picture, clipart and object, charts, drawing, text box and shapes, hyperlink macro, equation editor etc.
- 3. Slide Oriented Presentation:** Proposed application software: Microsoft power point. Topics: hyperlink, slide window detail, audio, video, animation, slide transition, lab assignment: simple slide based presentation (topics are free of choice).
- 4. Spread Sheet Analysis:** Proposed application software: Microsoft excel, topics: basic idea, cell formatting, equation, function, different data sheet calculation, lab assignment: grade sheet calculation, salary sheet calculation.
- 5. Internet topics:** Browsing concepts, searching in the web, e-mail.

## Reference:

1. MSDN (Microsoft developer network) library.
2. Microsoft Office 2000/XP Premium Edition- BPB Publicatios.
3. Peter Nortons Complete guide to MS Windows 2000 Professional
4. Internet (2<sup>nd</sup> Edn.)- BPB Publication,[ISBN: 81-7029-053-7]
5. Operating system by Andrew S. Tanenbaum- 7<sup>th</sup> edition.

## 2nd Semester

### **URAL-1202: Intermediate Arabic**

Credit Hour: 1

Contact Hours: 3 per week

Intermediate arabic course is designed for the 2<sup>nd</sup> semester students of all faculties other than shariah, the arabic language course is offered by the university to orient the students with language of the holy Qur'an and Sunnah and let them be enlightened with the guidance of Islam. It will make them eligible to co-operate with the Arabian world. Being familiar with arabic language will enable them to be benefited by the original Islamic references also.

This course has been provided for those who have become familiar with arabic alphabets along with the basic words and foundations of it. Any language course should go through listening, speaking, reading and writing. In order to fulfill this demand Intermediate Arabic course prescribes the following contents:

- i. **Introduction to the course and its objectives.**
- ii. **Dialogue between two persons:** (9 lesson), word meanings and making sentences, reading and listening practice, understanding the meaning of dialogue, question and answer practicing on prepared structures , making new dialogue.
- iii. **Passages:** (11 Lessons)- reading and listening practice, word meanings and making sentences-understanding the meaning of the passage, practicing comprehensions, filling in the blanks, structures and matching of synonyms-antonyms.
- iv. **Grammatical Part:** (11 Lessons) Hand writing practice, filling the blanks with appropriate words, making sentences by arranging words, joining sentences and usages of verbs.

### **URIS-1203: Introduction to Ibadah**

Credit Hour: 1

Contact Hour: 1 per week

**This course is designed:**

- a) To provide the students with proper knowledge about the Islamic way of life.
  - b) To make them aware of the mis-activities and traditions existing contradicted with the basic faith and knowledge of Islam.
  - c) To give them a clear concept about the all-embracing view of ibadah in Islam.
1. **Ibadah:** Its meaning and significance in Islam, scope of ibadah in Islam, objectives of ibadah, conditions of ibadah.
  2. **Characterstics of Ibadah in Islam:** Free from intermediaries, not being confined to specific places, all- embracing view.
  3. **Position of specific Rituals, Its Significance and Teachings:** Salah (prayer), sowm (fasting), zakah, hajj (pilgrimage).
  4. **Jihad:** Its definition, significance, importance, classification from various aspects.
  5. **Islam & Asceticism.**

**Recommended Books:**

1. Abdul Qayyum Natiq- Sirat-e- Mustaqum
2. Khurshed Ahmed - Islam its meaning & Message.
3. Syed Abul Ala Mawdudi - Towards Understanding Islam
4. Gulam Sarwar - ISLAM (Beliefs & Teachings)
5. Shah Abdul Hannan -Social Laws of Islam
6. Al- Qaradawi, Dr. Yusuf- The Lawful and the Prohibited in Islam
7. Syed Mahmudul Hasan- Islam

**Pharm-1201: Inorganic Pharmacy-I:**

Credit Hours: 3

Contact Hours: 3 per week

1. **Structure of Atoms:** Fundamental particles, origin of spectral lines and elementary treatment of theories of atomic structure, quantum numbers, Paulis exclusion principle, Hund's rule, Aufbau principle, shapes of s, p, d, f orbitals.
2. **Classification of Elements:** Electronic structure of atoms, modern periodic table and periodic law, variation of properties within periods and groups, usefulness and limitation of periodic table.
3. **The Chemical Bonds:** Electronic concept of valency, different types and formation of chemical bonds, e.g., ionic, covalent, co-ordinate covalent, metallic, hydrophobic, Vander Waal's force, hydrogen bond, etc., concept of atomic orbital, theories of covalent bonding and hybridization, biological importance of hydrogen bond.
4. **Co-ordination Compounds:** Definition, Werner's theory, electronic interpretation, structures of co-ordination compounds, valence bond theory and hybridization approach.
5. **Water:** Hardness of water, treatment of natural water, distilled water, demineralized water and official water, water for injection (WFI) etc.
6. **Basic concept on acids, bases, salts and pH:** Definitions, theory of acids & bases, classification of acids, bases & salts, strength of acids & bases, determination of strength gradient of acids & bases.

**Recommended Books:**

1. Malik, Tuli, Madan - Selected Topics of Inorganic Chemistry
2. S Z Haider - Inorganic Chemistry
3. L M Atherden - Benthely and Driver's Textbook of Pharmaceutical Chemistry
4. Roger's Inorganic Pharmaceutical Chemistry
5. Sharp- Inorganic Chemistry
6. Block JH- Inorganic, Medicinal and Pharmaceutical Chemistry
7. Moeller- Inorganic Chemistry
8. Discher- Modern Inorganic Pharmacy
9. Sattya Prokash- Advanced Inorganic Chemistry

**Pharm-1202 : Inorganic Pharmacy- I Lab**

Credit Hour: 1

Contact Hours: 3 per week

Qualitative analysis of inorganic ions and radicals:

Na<sup>+</sup>, K<sup>+</sup>, Al<sup>+3</sup>, Fe<sup>+2</sup>, Mn<sup>+</sup>, Ag<sup>+</sup>, Cu<sup>+</sup>, Cu<sup>+2</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, and CO<sub>3</sub><sup>-2</sup>, SO<sub>4</sub><sup>-2</sup>, NO<sub>3</sub><sup>-</sup>, PO<sub>4</sub><sup>-3</sup> etc.**Pharm-1203: Physical Pharmacy-II:**

Credit Hours: 4

Contact Hours: 4 per week

- 1. Reaction kinetics and stability of pharmaceuticals:** Definitions, rates & 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 photo-chemical stability, stability aspects of formulations, marketed products and clinical supplies, shelf life determination.
- 2. Adsorption and Interfacial phenomena:** Freundlich and Langmuir isotherms, BET equation. Electrical properties of interfaces, electrical double layer, Nernst and zeta potential, Gibbs equation. Spreading, surface active agents, emulgents, detergents and antifoaming agents. surfactants and drug activity. surfactants and Pharmaceutical products.
- 3. Rheology and Rheology of dispersed systems:** Newtonian liquids, Non-Newtonian materials, yield value, plastic and pseudoplastic 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 preparations 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 & their determination.
- 6. Electrochemical Cells:** Electrode and cell potentials, energies involved in electrode processes; reference electrodes, buffer solutions and measurement of pH; potentiometric titrations and oxidation reduction systems, concentration cells.
- 7. Solubility and Distribution phenomena:** General Principles, solvent-solute interaction, solubility of liquids in liquids, distribution of solutes between immiscible solvents.

**Recommended Books:**

1. Walter and Moor- Physical Chemistry
2. Lewis Glasston- Physical Chemistry
3. Castellon- Physical Chemistry
4. Barrow- Physical Chemistry
5. Remington's Pharmaceutical Sciences

6. Martin- Physical Pharmacy
7. Bhal and Tuli- The essential of Physical chemistry

### **Pharm-1204 : Physical Pharmacy-II Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Determination of heat of neutralization between a strong base and a strong acid.
2. Determination of distribution co-efficient of benzoic acid between ether and water.
3. Determination of absorption isotherm of oxalic acid by charcoal.
4. Determination of equilibrium constant of reaction,  $\text{KI} + \text{I}_2 \rightleftharpoons \text{KI}_3$
5. Standardization of  $\text{Na}_2\text{S}_2\text{O}_3$  solution by standard  $\text{K}_2\text{Cr}_2\text{O}_7$  solution.
6.  $\text{P}^{\text{H}}$  metric titration of an acid by a base.
7. Determination of viscosity of a liquid.

### **Pharm-1205: Pharmaceutical Microbiology & Immunology:**

Credit Hours: 4

Contact Hours: 5 per week

1. **Introduction to Microbiology:** Microbiology as a field of biology, place of microorganisms in the living field, prokaryotic and eukaryotic organisms, groups of microorganisms, areas of microbiology, application of microbiology.
2. **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 methods.
3. **Bacteria:** Nomenclature of bacteria, morphology and fine structures, cultivation of bacteria, nutritional requirements, bacteriological media, growth and reproduction, quantitative measurement of bacterial growth, maintenance and preservation of pure culture of bacteria, Pharmaceutical and beneficial bacteria.
4. **Viruses:** History of viruses, classification, characteristics, reproduction and culture of viruses, virus inhibition, control of virus infections, bacterial virus or bacteriophages, morphology and composition, cultivation of bacterial viruses, reproduction of bacterial viruses, Pharmaceutical importance of viruses.
5. **Fungi and Yeasts:** Types, morphology, reproduction and physiology, pathogenic yeasts, Pharmaceutical importance of fungi and yeasts.
6. **Rickettsiae:** Introduction, characteristics, pathogenic rickettsiae, laboratory diagnosis of rickettsial diseases.
7. **Immunology:**
  - a) Basic concept of immunology, infections, immunity, pathogenicity
  - b) Immunological products: preparation of official immunological products (vaccines and sera).
  - c) Primary and secondary defensive mechanism of body
  - d) Microbial resistance and interferon

**Recommended Books:**

1. Pelczar- Microbiology
2. Hugo, Russel- Pharmaceutical Microbiology
3. Atlas- Basic and Practical Microbiology
4. Stainer- Microbiology
5. Ronald M Weiner- Accompany Microbiology
6. Topley and Wilson- Principle of Bacteriology and Immunity
7. M R Chowdhury - Medical Microbiology
8. Briody- Microbiology and Infections
9. Jain- Pharmaceutical Microbiology
10. Bhatt and Ali- Pharmaceutical Microbiology
11. Burton- Microbiology for Health Sciences
12. Burgeys- Determinative Bacteriology

**Pharm-1206 : Pharmaceutical Microbiology & Immunology Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Study of microscope, incubator and autoclave etc.
2. Microscopic determination of bacteria, fungi, yeast and mould etc.
3. Gram staining procedure for identifying bacteria
4. Preparation and sterilization of bacterial media.
5. Disc diffusion method of antimicrobial screening of supplied sample against pathogenic bacteria.

**Pharm-1207: Pharmacognosy & Phytochemistry-I:**

Credit Hours: 3

Contact Hours: 4 per week

1. **Introduction:** Definition and scope of pharmacognosy, its historical developments.
2. **Drug literature and publications:** Pharmacopoeia, codex, formulary, dispensatory and index etc. official, non-official, un-official drugs.
3. **Crude drugs:** A general view of their origin, distributions, cultivation, collection, drying and storage, commerce and quality control,
  - a) Classification of drugs.
  - b) Preparation of drugs for commercial market
  - c) Evaluation of crude drugs.
  - d) Drug adulteration.
5. **Phytochemistry:** Extraction, separation, chromatography, types of plant constituents, comparative phytochemistry and chemotaxonomy.
6. **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 bees wax.
  - b) **Carbohydrate and related compounds:** Sugars and sugar containing drugs. sucrose, dextrose, glucose, fructose etc. polysaccharides and polysaccharide containing drugs, starches, dextrin etc. gums and mucilage, tragacanth, acacia, sterculia, sodium alginate, agar and cellulose
  - c) **Alkaloids:** Distribution, properties, tests, extraction, structural types and classification. Study of biological source, geographical source, chemical constituents and uses of areca, hemlock, conium etc
- 7. Plants in complimentary and traditional systems of medicine:** Introduction-different types of alternative systems of treatments (e.g. ayurvedic, unani and homeopathic medicine), contribution of traditional drugs to modern medicines.
- 8. Vitamins and vitamin containing few selected animal drugs:** Cod liver oil, shark liver oil, hilsa fish liver oil etc.

### **Recommended Books:**

1. A Gani - Pharmacognosy
2. Trease, Evan's- Introduction to Pharmacognosy
3. Mohammed Ali - Pharmacognosy
4. A Gani - Practical Phytochemistry
5. V E Tayler, L R Rrady, J E Robbers- Pharmacognosy
6. Wallis- Pharmacognosy
7. Raghunathan- Pharmacognosy and Indigenious Drugs
8. Jafar, Gandhi- Practical Pharmacognosy
9. Agarwal- Natural Products
10. Gasparic- Paper and Thin Layer Chromatography

### **Pharm-1208 : Pharmacognosy & Phytochemistry-I Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Study of some solutions and pharmacognosy practical reagents.
2. General test for carbohydrate (glucose, fructose, sucrose xylose.)
3. Study of various crude drugs ( leaf,bard,bud).
4. Physical and chemical test for starch.
5. Isolation of caseine from milk.

### **Pharm-1213: Oral Assessment-I**

Credit Hour: 1

Contact Hour: 1 per week

## **3<sup>rd</sup> Semester**

### **URIS-2303: Introduction to Qur'an and Sunnah**

Credit Hour: 1

Contact Hour: 1 per week

The main objectives of this course are as follows:

- a) To make the students familiar with the Qur'an and Sunnah as they are the main sources of islamic shariah.
- b) To achieve the main goal of the university of islamization of knowledge through enlightening the students with revealed knowledge of the Qur'an and the sunnah

**Introduction to Qur'an:** Definition of the Qur'an (literally and terminology), revelation of the holy Qur'an , preservation and compilation of the holy Qur'an, characteristics of the holy Qur'an, central subject-matter and the main themes of the holy Qur'an, the necessity of the holy Qur'an, the superiority of holy Qur'an as a scripture, makki and madani surahs and the characteristics of each, abrogation (nusk) in the holy Qur'an and its classification, inimitability of the holy Qur'an, asababunnauzul & its benefits.

**Introduction to Sunnah:** Its meaning, definition and the difference between sunnah and hadith, the importance of sunnah in islamic shariah, explanation of some important terms of sunnah, the authority of sunnah in islam, collection and compilation of sunnah, method of distinguishing a genuine hadith from a spurious Hadith 1) Al dirayat 2) Al riwayat.

3. **The Classification of Hadith:** According to the reference to a particular authority, according the links in the isnad, according to the number of reporters involved in each stages of the isnad, according to the number in which the Hadith is reported, according to the reliability and the memory of the reporter.

### **Recommended Books:**

1. Dr. Suhaib Hasan - The Science of Hadith
2. Abdul Qayyum Natiq- Sirat-e-Mustaqim
3. Mahmudul Hasan- Islam
4. Denffer, Ahmad- An Introduction to the Sciences of the Quran
5. Dr. Thameem Ushama- Sciences of the Quran: An Analytical Study
6. Dr. Mohammad Mustafa Azami- Studies in Early Hadith Literature

### **Pharm-2301: Inorganic Pharmacy-II:**

Credit Hours: 3

Contact Hours: 3 per week

**Alkali, Alkaline earth metals and Halogen:** Electronic configuration, physical and chemical properties of alkali, alkaline earth metals and halogens including their pharmaceutical applications.

**Oxidation-Reduction reactions:** Definition, oxidation number, equivalent weight of oxidant and reductant, decomposition of drugs by redox reaction, ion electron method of balancing equation, importance and determination of redox potential.

**Gastrointestinal agents:** Antacids, preparations and applications (Al and Mg), protective and adsorbents, saline cathartics, their preparations with applications.

**Radio Pharmacy:**

- a. i) Fundamental of radioactivity, natural and induced radioactivity, radioactive decay. Preparation and uses, control of radio pharmaceuticals.
- ii) Radiation detection and their measurement, principles and instrumentation of Geiger-Muller and Scintillation counter.
- iii) Uses of radio isotopes in pharmaceutical, medical and other related fields.
- b. Radio activation and isotope dilution analysis and radio isotope methodology.

5. **Pharmaceutical important salts:** General properties, preparation and uses of pharmaceutically important salts of Na, K, Mg, Ca, Fe, Cu, Al and Zn

**Impurities** in medicinal substances.

**Recommended Books:**

1. Malik, Tuli, Madan - Selected Topics of Inorganic Chemistry
2. S Z Haider - Inorganic Chemistry
3. L M Atherden- Benthely and Driver's Textbook of Pharmaceutical Chemistry
4. Roger's Inorganic Pharmaceutical Chemistry
5. Sharp- Inorganic Chemistry
6. Block JH- Inorganic, Medicinal and Pharmaceutical Chemistry
7. Moeller- Inorganic Chemistry
8. Discher- Modern Inorganic Pharmacy
9. Sattya Prokash- Advanced Inorganic Chemistry

**Pharm-2302 : Inorganic Pharmacy-II Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Identification of inorganic ions from pharmaceutical formulations.  
Ca<sup>+2</sup>, Fe<sup>+2</sup>, Al<sup>+3</sup>, Mg<sup>+2</sup>, K<sup>+</sup> and Na<sup>+</sup> ions form supplied preparations.
2. Conversion of different water insoluble or sparingly soluble drugs into water soluble form.
  - a. Na/K- salicylate from salicylic acid.
  - b. Na/K –benzoate form benzoic acid.
  - c. Na/K –citrate from citric acid.
3. Preparation of inorganic drugs:
  - a. Preparation of aluminum hydroxide gel.
  - b. Preparation of magnesium hydroxide.

**Pharm-2303: Organic Pharmacy-II:**

Credit Hours: 3

Contact Hours: 3 per week

1. **Introduction to organic chemistry:** Melting point, boiling point, solubility, acids, bases, polarity of bonds, carbanions, hydrides, protons, free radicals, hydrogen bonding etc.
2. **Principles of various types of reactions:**
  - a) Electrophilic, nucleophilic, free radical, addition and substitution reactions.
  - b) Elimination reactions.
  - c) Rearrangement reactions.
3. **Diene:** Classification, preparation and stability of dienes, conjugation, 1.2 and 1.4 additions, aromaticity, characteristic properties of aromatic compounds. Heterocyclic compounds. Pharmaceutical importance of such compounds and substituted aromatic compounds.
4. **Introduction to common essential drugs:** Preparations and uses of salicylic acid, aspirin, paracetamol, benzoic acid, benzylbenzoate, sulfa-drugs, PABA, isoniazid, halothane, enflurane, methoxyflurane, etc.
5. **Alicyclic compounds:** Introduction, methods of preparation, physical and chemical properties and pharmaceutical applications.

**Recommended Books:**

1. Morrison, Boyd- Organic Chemistry
2. B H Bahl and Bahl - Advance Organic Chemistry.
3. I L Finar - Organic Chemistry
4. Fox- Organic Chemistry
5. Synder- Modern Organic Chemistry
6. Sing, Kapoor- Organic Pharmaceutical Chemistry
7. Nadendlar- Pharmaceutical Organic Chemistry

**Pharm-2304 : Organic Pharmacy-II Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Identification of simple organic compounds.
2. Synthesis of simple compounds using name reactions.

**Pharm-2305: Pharmacognosy & Phytochemistry-II:**

Credit Hours: 3

Contact Hours: 5 per week

1. **Glycosides and glycoside containing drugs.** Biosynthesis of glycosides: The details of the following.
  - i. Cyanogenic- Wild cherry

- ii. Isothiocyanate-mustard (black-mustard and white mustard).
- iii. Cardiac- Digitalis, strophanthus, squill.
- iv. Saponins-Sarsaparilla, glycyrrhiza, dioscorea.
- v. Anthraquinone glycosides-Cascara sagrada, aloe, senna, rhubarb,
- vi. Other glycosides and neutral principles- Gentian, quassia, saffron.

**2. Alkaloids:** The details of the following:

Biosynthesis of tropane, quinoline, isoquinoline and indole alkaloids.

- i) Tropane-Belladonna, stramonium, hyoscyamus and lica
- ii) Quinoline-Cinchona, cusparia bark
- iii) Isoquinoline-Ipecac, opium, sanguinaria, curare
- iv) Indole-Ranwolfia, nux vomica, ergot, catharanthus
- v) Imidazole: Pilocarpine
- vi) Steroidal: Veretrum viride, aconite
- vii) Lupinea-Lupinus spp
- viii) Purine base-Coffee, tea etc.

**3. Volatile oils and related terpenoids-**Methods of obtaining volatile oils, chemistry, their medicinal and commercial uses, biosynthesis of some important volatile oils used as drugs.

Details of different types of volatile oils.

- i) Terpenes or sesquiterpenes: Pinus, juniper, cade
- ii) Alcohols: Coriander, Sandalwood, rose
- iii) Ester: Peppermint, lavender, rosemary
- iv) Aldehydes: Cinnamon bark, eucalyptus, lemon peel, lemon grass.
- v) Ketones: Spearmint, caraway, dill, camphor
- vi) Phenols: Clove, cinnamon leaf, Arjowan
- vii) Ethers: Fennel, nutmeg, eucalyptus, cajuput
- viii) Peroxides: Chenopodium
- ix) Others: Mustard, wintergreen, bitter almond

**4. Phenolic compounds and tannins:** Chemical nature and test for tannins some taruin containing drugs such as nutgall and catechu.

**5. Resin and resin combinations:** Resin, oleoresin, oleo-gum resin, tolu balsam and benzoin.

**6. Poisonous plants and natural pesticides:** Datura, poison hemlock, water hemlock, foxglove (digitalis), ipornoca, tobacco, poppy, pyrethrum flower, derris & lanchoarpus, red squill, strychnine, etc.

**Recommended Books:**

- 1. A Gani - Pharmacognosy
- 2. Trease , Evan's - Introduction to Pharmacognosy
- 3. Mohammed Ali - Pharmacognosy
- 4. A Gani - Practical Phytochemistry
- 5. V E Tayler, L R Rrady, J E Robbers- Pharmacognosy
- 6. Basu- Indian Medicinal Plants

**Pharm-2306: Pharmacognosy & Phytochemistry-II Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Study of some solutions and reagents used in pharmacognosy laboratory.
2. Demonstration of presence of tannin in supplied crude drug (clove)
3. Extraction of alkaloids from supplied sample:
  - i) Tea leaves
  - ii) Betel nut
  - iii) Atropa belladonna
4. Demonstration of presence of Anthraquinone glycosides (Senna leaves)
5. Study of drug containing leaves.

**Pharm-2307: Biomolecular Pharmacy and Biotechnology-I :**

Credit Hours: 3

Contact Hours: 4 per week

**1. General Introduction to Biotechnology:**

Definition and historical perspective, scope, potential and achievements, Pharmacist and biotechnology, Biotechnology and industry; GMP compliance and Biopharmaceutical facilities, biotechnology and biodiversity.

**2. Carbohydrates:**

General considerations, chemistry, stereochemistry, classification, aldoses, ketoses, oxidation, effect of alkali, Kiliani-Fisher synthesis of aldoses. Ruftdegradation of optical family, D-L, R-S, cyclic structures of D(+)glucose, mutarotation, hemiacetal-acetal form of glucose, ring size determination, disaccharide's, structure determination 'of polysaccharides, starch, cellulose, glycogen; chemical and pharmaceutical importance of carbohydrates, blood sugar, glycogenesis, glycolysis, TCA cycle, metabolism of carbohydrates.

**3. Lipids:**

General consideration, chemistry, biosynthesis of fats and fatty acids, catabolism of fat, fatty acid cycle,  $\beta$ -oxidation, catabolism of unsaturated fatty acids, ketone bodies, ketosis, ketourea, ketoacidosis, diabetic coma and its treatment, lactic acid and acidosis, phosphoglycerides, steroid and bile salts.

**4. Amino Acids & Proteins:**

General considerations, structure of amino acids, acidity and basicity of amino acids, isoelectric point, preparation and reactions of amino acids, essential amino acid, peptide synthesis, amino acid sequence determination, metabolism of amino acids, deamination, transamination, racimization etc., classification and functions of protein structure, denaturation of proteins, purification of proteins, electrophoresis, enzymes as protein, one carbon unit transfer, proteins as drugs.

**5. Enzymes Coenzymes and isoenzyme:**

Chemical nature, classification, catalytic properties, enzyme specificity, mechanism of enzyme actions, enzyme catalyzed reactions, enzyme activation and inhibition, competitive inhibition, allosteric inhibition, irreversible inhibition of poisons and toxins, chemotherapy and enzyme inhibition, coenzymes, thiamin pyrophosphate,

flavin coenzyme, pantothenic acid,  $\text{NAD}^+$ ,  $\text{NADH}^+$ ,  $\text{NADPH}^+$ , pyridoxal pyrophosphate, biotin, vit.  $\text{B}_{12}$ , coenzymes isoenzyme and isoenzyme in clinical use.

### **Pharm-2308: Biomolecular Pharmacy and Biotechnology-I Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Qualitative Test of
  - a. Carbohydrate
  - b. Protein and
  - c. Fats
2. Quantitative test of
  - a. Normal urine and
  - b. Abnormal urine.
3. Isoenzyme in clinical use.
4. Estimation of blood sugars.
5. Estimation of blood lipids

### **Recommended Books:**

1. Berg, Tymoczko, Stryer : Biochemistry
2. D L Nelson, M M Cox: Lehninger's Principles of Biochemistry
3. Murry G ., M Rodwell : Harper's Biochemistry
4. A. C. Dev- Biochemistry
5. Rex Montgomery- Biochemistry
6. Stryer- Biochemistry
7. Harper- Biochemistry
8. Elliot- Biochemistry and Molecular Biology
9. Robertis- Cell and Molecular Biology
10. Sharma and Dandiya- Pharmaceutical Biochemistry

### **Pharm-2309: Human Physiology-I:**

Credit Hours: 4

Contact Hours: 4 per week

1. **Blood** : Composition & functions
  - Plasma : Electrolytes, proteins & other organic constituents.
  - Blood cells : Formation& destruction cell count, functions of different blood cells.
  - Hemoglobin : Structure, properties & function.
  - Anemia : Causes & classification.
  - Blood coagulation : Blood groups, blood transfusion.
  - Lymph : Composition, formation, circulation & function, lymph nodes & lymphatic.

2. **Circulatory system :**

Heart : Structure, heart muscles, conduction system of heart, origin and transmission of cardiac impulse; ECG, control and requirements for the normal heart beat. Cardiac cycle, cardiac output, nervous regulation of heart, cardiac reflexes.

Blood vessels : Types of blood vessels & their functions.

Blood pressure : Measurements and regulation of blood pressure, nervous control and chemical control. arterial pulse: definition & clinical study, recording of arterial pulse, capillary circulation: importance & functions,

3. **Respiratory system:** Mechanism of respiration. Pulmonary ventilation, ventilation volumes, gaseous interchange through lungs: Carriage of  $O_2$  &  $CO_2$ , regulation of respiration: Nervous and chemical regulation, hypoxia: causes & classification. abnormal breathing, Cheyne Stokes breathing, Kussmaul breathing, breathing at high altitude.

4. **Alimentary system :** Structure of the different parts of the alimentary system, movements of the different parts of the alimentary tract & their control, swallowing, gastric contractions, intestinal contractions, defecation secretion of digestive juices, saliva, gastric juice, pancreatic juice, intestinal juice & bile, mechanism & control of the various secretions and their functions, digestion of foodstuff. absorption of the different digested materials. structure and functions of liver, formation of bile & its concentration in the gall bladder, circulation of bile salts & bile pigments, functions of liver.

**Recommended Books:**

1. Guyton- Text Book of Medical Physiology
2. Ganong – Medical Physiology
3. Miller- Anatomy and Physiology
4. Sahana- Human Physiology
5. Samson Wright- The Blood
6. M. A. Rahman- Blood
7. Franklia Green- Cardiovascular and Palmonary Physiology
8. C. L. Ghai- Practical Physiology
9. Meftun Ahmed- Physiology of Blood

**Pharm-2310 : Human Physiology-I Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Study of compound microscope
2. Estimation of hemoglobin.
3. Determination of clotting & bleeding time.
4. Total count of R.B.C and W.B.C.
5. Determination of ESR.
6. Blood grouping & Rh typing

## 4<sup>th</sup> Semester

### **URIS-2405: Dealings and Behavior in Islam**

Credit Hour: 1

Contact Hour: 1 per week

To bring up the students with Islamic manners for the sake of making them dutiful towards Allah and His creatures.

- i. Mua'malah:** Its definition and scope
- ii. Social life in Islam:** Family life in Islam, role of marriage as the basis of Islamic family, status of women in Islam, rights and duties of women in Islam, husband-wife relations (duties and obligations to each other), rights of children in Islam, duties towards parents.
- iii. Economic system of Islam:** Earning and expenditure by halal means, right to property and individual liberty, system of zakah, prohibition of interest (Riba), law of inheritance (Mirath).
- iv. Islamic Law regarding business, dress up and social relations.**
- v. Duties and obligations:** Duty towards parents, relatives, neighbors, guests, needy and orphan.
- vi. Social manners:** Brotherhood, greetings, co-operation, meetings, talking, keeping promise, seeking permission before entering someone's house.
- vii. Basic virtues:** Honesty, truthfulness, kindness, perseverance, firmness against evil, tolerance, punctuality, courage, trust worthiness, forgiveness, charity and cloak for women, intention, promise, modesty, charity, gifts, thankfulness, visiting the sick.
- viii. Bad conduct:** Lying, back-biting, spying and suspicion, extravagance, hypocrisy, mischief and corruption etc.

### **Pharm-2401: Human Physiology-II:**

Credit Hours: 4

Contact Hours: 5 per week

- 1. Nervous System:** Properties of nerve cells, nerve impulses and their transmission, reflex action, principal afferent and efferent paths of CNS. functions of spinal cord and brain. The autonomic nervous system. properties of synapses and synaptic transmission.
- 2. Excretory System:** Structure and functions of kidney, composition and formation of urine, renal circulation, renal regulation of acid base balance, renal diseases and kidney function tests, physiology of micturition. Artificial kidney: basic principles, method and applications.
- 3. Endocrine Glands:** Structure and functions of pituitary, thyroid, parathyroid, suprarenal and pancreas.

4. **Reproductive system:** Male reproductive system: Testis & the accessory of organs. Male sex hormone, formation of spermatozoa & its control by various hormones, Female reproductive system: Ovaries, Uterus, Oviduct etc., menstrual cycle & its control, diagnosis of pregnancy, female sex hormones: Estrogens & progesterone, pregnancy & lactation & their hormonal control.
5. **Metabolism:** Fat, carbohydrate, protein and nucleoprotein metabolism. Metabolic pathways of fat, carbohydrate & proteins, enzymes, vitamins and hormones regulating various metabolic steps; vitamin & minerals. Their physiological properties and functions.

### Recommended Books:

1. Franklia Green- Cardiovascular and Pulmonary Physiology
2. Ross and Wilson- Anatomy and Physiology
3. Tortora and Evan- Principle of Human Physiology
4. C. C. Chattarjee- Human Physiology
5. Vernon- Medical Physiology
6. Steadman- Human Physiology
7. Selim Reza- Human Physiology
8. Best and Tylors- Physiological Basis of Medical Practice
9. Shalya- Human Physiology
10. C. L. Ghai- Practical Physiology
11. Guyton- Text book of Human Physiology

### Pharm-2402 : Human Physiology-II Lab:

Credit Hour: 1

Contact Hours: 3 per week

1. Measurement of blood Pressure.
2. Fragility test of R.B.C.
3. Biochemical test on saliva.
4. Effect of ptyalin on starch.
5. Estimation of blood sugar in normal person.
6. Effect of electrolytes on heart beat of toad.
7. Effect of heat on heart beat of toad.(by kymograph).
8. Effect of exercise on blood pressure.

### Pharm-2403: Pharmaceutical Technology –I:

Credit Hours: 3

Contact Hours: 4 per week

#### 1. 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.

**2. Pre-formulation:**

Preliminary evaluation and molecular optimization, bulk characterization of the material, crystal nature and polymorphism, thermal properties, hygroscopicity, particle characterization, bulk density, powder flow properties, solubility analysis,  $p^{ka}$  determination, pH solubility profile, effect of temperature, solubilization, partition coefficient, dissolution, stability analysis. solution stability and solid state stability.

**3. Incompatibilities.** Chemical, physical and therapeutic incompatibilities.**4. Pharmaceutical excipients:**

Chemistry, physical properties and uses of following excipients: acidifying agents, air displacement agents, alkalizing agent, antifoaming agents, antimicrobial preservatives, anti oxidants, buffering agents, chelating agents, colors, complexing agents, emulsifying agents, flavoring agents and perfumes, humectant, ointment bases, solvents, stiffening agents, wetting and solubilizing agents.

**5. 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 systems of liquids.

**6. Dispersed Systems:**

**Properties of dispersed systems:** Theoretical aspects of suspension, emulsion, & colloids, surface characteristics and zeta potential, inter-particle force, crystal growth, wetting, adsorption at solid-liquid interface, surface and interfacial tension, flocculation and coalescence .

**Suspensions:** Advantages and disadvantages aggregated and dispersed systems, formulation of suspensions, manufacturing of suspension, stability of suspension, evaluation and quality analysis of suspension, rheological considerations and illustrative examples.

**Emulsions:** Definitions and applications, advantages and disadvantages, theory 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.

**7. Semisolid (Ointments, pastes, gels):**

Structure of skin, percutaneous absorption of drugs, definition and classification of semisolid, classification of ointment bases, formulation of ointments, manufacturing of ointments, rheological consideration, evaluation and quality analysis of ointment.

**Recommended Books:**

1. Lachman, Lieberman , King ; The Theory and Practice of Industrial Pharmacy
2. N K Jain ; Pharmaceutical Arithmetic
3. A Handbook of Pharmaceutical Excipients
4. Remington's Pharmaceuticals Sciences
5. Budhiraja- Practical Pharmacy

6. Ghosh- Handbook of Pharmaceutical Technology
7. SP Vyas- Controlled Drug Delivery
8. Alderborn- Pharmaceutical Powder Compaction Technology

**Pharm-2404: Pharmaceutical Technology –I Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Preparation of paracetamol syrup.
2. Preparation of paracetamol suspension
3. Preparation of cotrim suspension
4. Preparation of phenobarbital sodium syrup.
5. Preparation of aromatic water.
6. Preparation of promethazine HCl syrup.

**Pharm-2405: Pharmacology-I:**

Credit Hours: 4

Contact Hours: 4 per week

**General Pharmacology:** Methods of drug administration, biological half life, drug absorption, bioavailability, distribution of drugs, protein binding, accumulation and storage in body, drug dilution in the body fluid, metabolism of drugs and excretion. Drug allergy, idiosyncrasy, drug toxicity and drug interaction.

**Analgesics and Antipyretics:** Concept of pain and fever causes of pain and fever. narcotic analgesics, opium alkaloids, methadone and propoxyphene, morphine antagonists, oxycodone, hydrocodone, dihydrocodeine and dextromethorphan, non narcotic analgesics, aspirin, salicylates, pyrazolone derivatives, anti-inflammatory agents, concept of inflammation, indomethacin, salindac, the'fenamates, toimetin, propionic acid derivatives, drugs used in the treatments of gout-allopurinol, colchicine etc. steroidal anti-inflammatory agents.

**Gastric Antacids:** General consideration, chemistry, absorption, distribution and excretion, action and effects of gastric antacids. mode of action, related adverse effects, classification of antacids, aluminium hydroxide, aluminum carbonate, Mg-hydroxide and oxide, magnesium carbonate, magnesium trisilicate, sodium bicarbonate, antacid mixtures, colloidal bismuth, H<sub>2</sub>-receptor antagonists-cimetidine and ranitidine, proton pump inhibitors etc.

**Autacoids:**

- a) Histamines and antihistamines, mode of action of histamines on cardiovascular system, smooth muscle, gastric secretion, anaphylactic shock, histamine releasing drugs, allergic disorder, antihistamines: classification, pharmacological action, action on CNS, therapeutic uses, absorption, distributions and excretion, adverse reactions etc.
- b) Serotonine and serotonine antagonists.
- c) Occurance, pharmacological action, prostaglandin's, prostacyclines and tromboxane,

d) The Kinins: kallidins and bradykinin.

**Anesthetics:** Introduction and classification.

- a) Local anesthetics: general properties, chemistry and SAR, mechanism of action, pharmacological action, clinical use and fate of cocaine, procaine, benzocaine, lignocaine, lidocaine, etc.
- b) General anesthetics. (i) Inhalation anesthetics: Halothene, enflurane, methoxyflurane, nitrous oxide, diethyl ether, cyclopropane and ethylene, etc. (ii) Intravenous anesthetics: Barbiturates, opioids, etc.

**Vitamin:** Water soluble and fat soluble vitamins

**Haematinics and Anticoagulants**

### Recommended Books:

1. Goodman, Gilman: Pharmacological basis of Therapeutics
2. H P Rang: Pharmacology
3. Satoskar- Pharmacology and Pharmacotherapeutics
4. Goth- Medical Pharmacology
5. Katzung- Pharmacology
6. Kalant- Pharmacology
7. Lippincots- Pharmacology
8. Craig- Pharmacology
- 9.

### Pharm-2406: Pharmacology-I Lab:

Credit Hour: 1

Contact Hours: 3 per week

1. Study of prescription:
  - a) Peptic ulcer
  - b) Hypertension
  - c) Tuberculosis
2. Diuretic effects of mannitol on frog
3. Effects of Na- phenobarbitone
4. Diuretic effects of frusemide on frog.
5. Effects of local anesthetics on rat's tail.

### Pharm-2407: Bio-molecular Pharmacy and Biotechnology-II:

Credit Hours: 3

Contact Hours: 4 per week

1. **Nucleic Acid:** Structure, isolation, purification and molecular weight determination, chemical and enzymatic hydrolysis and hybridization.
2. **Central Dogma of Molecular Biology:**
  - a) Replication: DNA replication, DNA polymerases, types of DNA replication, and inhibitors of replication.
  - b) Transcription: RNA synthesis and mRNA processing (post-transnational modification of mRNA, promoters, enhancers and transcriptional factor) in bacteria and yeast, inhibitors of transcription.

- c) Genetic code: Characteristic feature of genetic code, Wooble hypothesis with experimental evidence, initiation and termination codon.
- a) Translation: Structure of Ribosome, mechanism of translation, (protein synthesis), post-translational modification, inhibitors of translation.
- 3. Techniques in Molecular Biology:** Polymerase chain reaction (PCR), DNA sequencing techniques, southern, northern and western blotting. agarose gel electrophoresis, SDS PAGE, TR-PCR, *in vitro* kinase assay Real time PCR.
- 4. Mutation:** Types of mutation, molecular mechanism of mutation, site specific mutagenesis, mutation hot spot, DNA repair mechanism, inheritant mutation diseases.
- 5. Restriction enzymes:** Sources, specificity, digestion of DNA fragments by restriction enzymes.
- 6. Fermentation:** General consideration: Introduction and historical perspectives, the fermentation process and optimization; Improvement of microbial strain-Mutations, recombination, protoplast fusion; fermenters: structure, size, culture vessel, agitation systems, process monitoring and control, cleaning and sterilization; Types of fermenters (Bioreactors), fermenter designs.
- 7. Fermentation Technology:**  
 Fermentation of industrial products: antibiotics: penicillin, tetracycline; amino acids: L-lysine, L-glutamic acid; vitamins: ascorbic acid, riboflavin; alcohol: ethanol from molasses.

### **Recommended Books:**

1. Berg, Tymoczko, Stryer : Biochemistry
2. D L Nelson, M M Cox: Lehninger's Principles of Biochemistry
3. Murry G ., M Rodwell : Harper's Biochemistry
4. A. C. Dev- Biochemistry
5. Rex Montgomery- Biochemistry
6. Stryer- Biochemistry
7. Harper- Biochemistry
8. Elliot- Biochemistry and Molecular Biology
9. Robertis- Cell and Molecular Biology
10. Sharma and Dandiya- Pharmaceutical Biochemistry
11. Introduction to Biotechnology- S. K. Jain

### **Pharm-2408: Bio-molecular Pharmacy and Biotechnology-II Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Estimation of Protein concentration from the supplied sample by Lowry method.
2. Extraction and purification of Plasmid DNA.
3. Study of the agarose gel electrophoresis.

### **Pharm-2413: Oral Assessment-II**

Credit Hour: 1

Contact Hour: 1 per week

## 5<sup>th</sup> Semester

### **URIS-3505 :Government and Politics in Islam**

Credit Hour: 1

Contact Hour: 1 per week

To introduce the political system of Islam with its concepts characteristics and principles (Special emphasis on sovereignty of Allah, shurah and khilafah)

1. Islamic political system
2. State and sovereignty
3. Concepts of politics in Islam
4. Salient feature of Islamic political order
5. Organs of a government with special reference to Islamic viewpoint
6. Principles of Islamic Rule
7. Major characteristics of a constitution based on the Qur'an and the Sunnah.

### **Recommended Books:**

1. Prof. Dr. A. Rashid Motin : "Political Science: Islamic Perspective"
2. M.A Hai Haqqani : "The super Social System of Islam"
3. G.W Chowdhury : "Islam & The Contemporary World "
4. Prof. Masudul Hasan : Reconstruction of Political Thought in Islam.

### **Pharm-3501: Pharmaceutical Technology-II:**

Credit Hours: 2

Contact Hours: 4 per week

1. **Formulation & Manufacturing of Tablets:** Manufacturing of tablets by wet granulation, dry granulation & direct compression, granulation of powders for tableting, advantages and disadvantages of different processes and machineries used in tablet manufacturing, 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, study of common tableting problems.

2. **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; theory of film coating, film formers, plasticizer, solvents, enteric coating: enteric coating polymers, formulations of enteric coating, dry coating (compression coating), 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, coating machines: conventional coating machines, perforated coating machines, fluidized coating machines.

### **3. Capsule:**

- a) **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 etc

- b) **Soft gelatin capsules:** Definitions and classifications, advantages and limitations, properties, formulation, manufacturing, quality control and packaging of soft capsules. Problems and remedy of soft capsule manufacturing.

**4. Microencapsulation Technology:** Purpose, methods of preparation, evaluation, pharmaceutical and biological applications of microencapsulation process.

#### **Recommended Books:**

1. Lachman, Lieberman, King: The Theory and Practice of Industrial Pharmacy
2. Remington's Pharmaceuticals Sciences
3. H A Liberman: Pharmaceutical Dosages form
4. Ansel : Dosages form Design
5. Sprawl's ;American Pharmacy.
6. Avis- Pharmaceutical Dosage Forms- Parenteral Medications
7. British Pharmacopoeia
8. United States Pharmacopoeia

#### **Pharm-3502: Pharmaceutical Technology-II Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Preparation of iron syrup.
2. Preparation of antacid suspension
3. Hardness test of tablet.
4. Friability test of tablet.
5. Disintegration test of tablet.
6. Preparation of castor oil emulsion.
7. Preparation of paraffin oil emulsion.

#### **Pharm-3503: Pharmacology-II**

Credit Hours: 4

Contact Hours: 5 per week

**1. Mechanism of Drug Action:** a) Basic concept of drug action. b) Physico-chemical nature of drugs. c) Drug receptors. d) Binding forces in drug-receptor interaction e) Receptor and non receptor mechanisms of drugs. f) Macromolecular nature of drug receptors. g) Relationship between drug concentrations versus response: Concentration-effect curve and receptor binding of agonists, competitive and irreversible antagonism, partial agonists, receptor-effector coupling and spare receptors, other mechanisms of drug antagonism.

**2. Antibiotics and Chemotherapeutic Agents:** Introduction, classification, chemistry, mode of action, structure-activity relationship, pharmacokinetics, indications, contraindications. Dose, adverse effects and drug interactions of the following individual class of drugs: i) Sulfa drugs. ii) Penicillins and cephalosporins. iii) Tetracyclins, Chloramphenicol, Aminoglycosides and Macrolides. iv) Antifungal agents. v)

Antileprosy drugs. vi) Miscellaneous antibacterial agents: a) Glycopeptide antibiotics. (b) Polymixin antibiotics. (c) Bacitracin. (d) Nitrofurantoin.

**3. Cardiovascular Drugs:** **1)** Functioning and diseases of the heart, arrhythmia, ischemia, angina pectoris, coronary thrombosis, myocardial infarction, arteriosclerosis, atherosclerosis, hypertension and congestive heart failure. **2)** Introduction, classification, chemistry, mode of action, structure activity relationship, pharmacokinetics, indications, contra indications, dose, adverse effects and drug interactions of the following individual class of drugs: a) Digitalis and allied drugs b) Antihypertensive drugs: (i)  $\alpha$ -Blockers, prazosin, etc. (ii)  $\beta$ -Blockers, Propranolol, etc. (iii) M.A.O. inhibitors, Methyldopa, Rauwolfia alkaloids. (iv) Ca-channel blocking agents. (v) Vasodilators: Nitrites and nitrates. **3)** Diuretics: Cardiac anhydrase inhibitors, low and high ceiling diuretics, potassium sparing diuretics and osmotic diuretics. **4)** Antiarrhythmic drugs: Quinidine, Procaine amide.

**4. Antidiabetic Drugs:** **a)** Introduction and classification of diabetes. **b)** Hyperglycemia and hypoglycemia. **c)** Introduction, classification, chemistry, mode of action, structure activity relationship, pharmacokinetics, indications, contraindications, dose, adverse effects and drug interaction of the following individual class of drugs: Oral hypoglycemic agents: (i) Sulfonylureas (ii) Biguanides. Hormone preparation: insulin. Management of diabetes mellitus.

**5. Anticancer Agents:** (a) Alkylating agents: Nitrogen mustard, alkyl sulphonates and nitrosoureas. (b) Anti-metabolites: (i) Folic acid analog (ii) Pyrimidine analog (iii) Purine analog and related inhibitors. (c) Natural products: (i) Vinca alkaloids (ii) Antibiotics (iii) Miscellaneous agents (metal complexes, radioisotopes, hormones, etc.)

**6. Psychotropic Drugs:** Classification, mode of action, SAR, pharmacological actions, indications, toxicities and contraindications of chlorpromazine, benzodiazepam, TCA, MAO inhibitors, etc.

**7. Drugs Affecting Renal Function:** Osmotic diuretics, carbonic anhydrase inhibitors, potassium sparing diuretics, high ceiling diuretics.

### Recommended Books:

1. Goodman, Gilman: Pharmacological basis of Therapeutics
2. H P Rang: Pharmacology
3. Grover- Pharmacy and Pharmacology
4. Model, Schild- Applied Pharmacology
5. Tripathi- Pharmacology
6. Andress Goth; Medical Pharmacology.
7. Singhal- Pharmacology Laboratory Manual
8. Bevan- Pharmacology
9. Melmon- Clinical Pharmacology

**Pharm-3504 : Pharmacology-II Lab**

Credit hour: 1

Contact hours: 3 /week

1. Study of prescription of
  - a) Asthma
  - b) Typhoid
  - c) Congestive Cardiac Failure
2. Determination of blood level of aspirin
3. Estimation of blood glucose level in fasting condition.
4. Estimation of blood glucose level after oral administration of glucose.
5. Microbiological assay of antibiotic.

**Pharm-3505: Biopharmaceutics & Pharmacokinetics-I:**

Credit Hours: 3

Contact Hours: 4 per week

1. **Introduction** to Pharmaceutics and Biopharmaceutics.
2. **Gastrointestinal Absorption of Drugs:**
  - a) Biological Consideration: Membrane physiology, gastrointestinal physiology, mechanism of absorption etc.
  - b) Physicochemical Consideration: pKa 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: Biological half-life, apparent volume of distribution, area under the curve, absorption and 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 bindings 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) Theoretical aspects of drug elimination, excretion and biotransformation.
  - b) Renal Elimination: Glomerular filtration, active tubular secretion, tubular reabsorption. Determination of renal clearance.
  - c) Biotransformation of Drugs: Definition, drug biotransformation reactions, pharmacokinetics of drugs and metabolites (Michelis-Menten equation), hepatic elimination, first pass effect, liver excretion ratio, relation between absolute bioavailability and liver excretion, hepatic clearance- relationship between 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 drug.

### Recommended Books:

1. Leon Shargel : Applied Biopharmaceutics and Pharmacokinetics
2. Gibaldi- Biopharmaceutics and Clinical Pharmacokinetics
3. Bourne- Pharmacokinetics
4. Cadwallader- Biopharmaceutics
5. Heremath- Textbook of Biopharmaceutics

### Pharm-3506: Biopharmaceutics & Pharmacokinetics-I Lab:

Credit Hour: 1

Contact Hours: 3 per week

- a) Preparation of gastric and enteric simulated fluid.
- b) Effect of pH on disintegration.
- c) Disintegration test of the uncoated tablet.
- d) Disintegration test of the enteric coated tablet.
- e) Determination of Binding Sites and Association constant.

### Pharm-3507: Medicinal Chemistry-I:

Credit Hours: 4

Contact Hours: 5 per week

#### 1. Heterocyclic compounds of medicinal interest:

- i) 5-membered heterocyclic compounds: Pyrrole, furan, thiophene, pyrazole, imidazole, oxazole, isoxazole, thiazole and isothiazole: their properties, reactions and pharmaceutical importance.
- ii) 6-membered heterocyclic compounds: Pyridine, piperidine, pyrimidine, pyradazine, pyrazine and triazine: their properties, reactions and pharmaceutical importance.
- iii) Benzofused 5 –membered heteroaromatic compounds: Ondole, benzofuran, benzothiaphene and carbazole: their properties, reactions and pharmaceutical importance.
- iv) Benzofused 6 –membered heteroaromatic compounds: Quinoline and isoquinoline: their properties, reactions and pharmaceutical importance.

2. **Name Reactions:** Baeyer-Villiger reduction, Friedel-Crafts alkylation and acylation reaction, Gabriel synthesis, Gattermann-Koch and Sandmeyer reaction, Hoffman degradation reaction, Mannich reaction, Perkin reaction, Reformatsky reaction, Reimer-Tiemann reaction.

#### 3. Chemistry of Natural Products:

- a) Alkaloids: Occurrence, isolation, classification and properties of alkaloids, structure determination, synthesis and physiological activities of ephedrine, nicotine, atropine and morphine and pharmaceutical application.
- b) Terpenoids: Occurrence, isolation and classification, synthesis of geraniol, citral ionones and amyryn and pharmaceutical application.

- c) Vitamins: Occurrence, classification and general methods of isolation of vitamins, structure determination, synthesis and biological functions of vitamin-A, vitamin -B and vitamin -C, and pharmaceutical application.
- d) Antibiotics: Occurrence, isolation, structure determination, synthesis and clinical properties of penicillin, streptomycin, chloramphenicol and tetracycline and pharmaceutical application.

### Recommended Books:

1. Patrick : A Introduction to Medicinal Chemistry
2. Wison, Gisvold's : Textbook of Organic Medicinal and Pharmaceutical Chemistry
3. Agarawal; Medicinal Chemistry
4. A Kar : Medicinal Chemistry
5. Willium O Foye- Medicinal Chemistry
6. Parimoo- Text Book of Medicinal Chemistry
7. Wilson, Gisvold- Text book of Organic, Medicinal and Pharmaceutical Chemistry

### Pharm-3509: Pharmaceutical Analysis-I:

Credit Hours: 3

Contact Hours: 4 per week

1. **Introduction and Techniques of Pharmaceutical Analysis:**
  - a) Introduction: Selection of samples, selection of chemicals.
  - b) The art and science of pharmaceutical analysis.
  - c) Choosing the tools, identification of containers, filtration, ignition of precipitates, drying of samples, recording results.
2. **Aqueous Acid Base Titration:**  
Definitions, Distribution of acid-base species with pH of the medium, acid-base titrimetry for determination of weakly acidic and basic pharmaceuticals, indicators (theories) and their selection, applications.
3. **Oxidation Reduction Titration:**  
Principles and concepts, determination involving potassium permanganate, potassium dichromate and potassium bromate. iodimetric and iodometric determination, miscellaneous oxidation and reduction titrations, indicators applications.
4. **Complexometric Titration:**  
Introduction to complexometric titration. complexes and chelates, stability of complex ions. Titration based on complex formation, types of complexometric titrations. Technique employed in chelometric titration, methods of end point detection, titration selectivity and masking reagents.

5. **Aquametry:**  
Principle and scope. Physical methods of water determination, Chemical methods of water determination, Karl-Fischer procedure: Principle, chemistry, methodology, equipment, end point detection and limitations.
6. **Non-Aqueous Acid Base Titrimetry:**  
Theoretical considerations and principles, Bronsted Lowery of acids and bases. non-aqueous solvents, titration of weak acids and weak bases, applications and scope of non-aqueous titrations.
7. **Visible and Ultraviolet Spectrophotometry:**  
Introduction, electromagnetic radiation, units, electromagnetic spectra and absorption of radiation, Lambert's and Beer's Laws, Deviation from Lambert-Beer's law, Instrumentation, colorometry, chromophores and auxochromes, analysis of mixtures, absorption and intensity shifts, applications of ultraviolet and visible Spectroscopy in quantitative analysis of drugs.

### **Recommended Books:**

1. Leslie G Chatten: Pharmaceutical Chemistry vol.1
2. Vogel: Quantitative Analysis
3. Higuchi- Pharmaceutical Analysis
4. Jenkins- Quantitative Pharmaceutical Chemistry
5. Alexeyev- Quantitative Analysis
6. Cornors- Pharmaceutical Analysis
7. Bentley and Driver- A Text Book of Pharmaceutical Chemistry

### **Pharm-3510 : Pharmaceutical Analysis-I Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Determination of potency of amoxicillin (Titration)
2. Determination of potency of ferrous sulphate (Titration)
3. Determination of potency of chloroquine phosphate (Titration)
4. Estimation of potassium chloride with sample (Titration).
5. Determination of potency of aspirin (Titration).
- 6 Determination of potency of paracetamol (Sp. Analysis)
7. Determination of potency of diclofenac sodium (Sp Analysis)
8. Determination of potency of ranitidine HCl (Sp. Analysis)

## 6<sup>th</sup> Semester

### **URIH-3607: Biography of the Prophet (SAW)**

Credit Hours: 2

Contact Hours: 2 per week

To introduce the ideal history of Muhammad (SAW). Special emphasis on his dawah and way of establishing Islam.

1. Importance of prophets biography, condition of Arab in the time of prophet Mohammad(SAW), birth and childhood, prophet Muhammad (SAW) with his foster mother 'Halimah', business trip to Syria with his uncle Abu Talib.
2. Battle of Fuzzar and Hilful-Fudul, contribution of Mohammad (SAW) in the business of Khadijah, marriage, rebuilding of Al-ka'bah
3. Search for the truth, receiving the truth, Islamic movement begins, early muslims.
4. Prophet (SAW) on the mount Safa, Embracing Islam by Hamjah (R :), emigration to Abyssinia, Umar (R :) accepts Islam.
5. Boycott agreement and confinement of banu Hashim, the year sorrow, taif-the most difficult day, al- miraj.
6. Covenants/contract of al-aqabah, hijrah of the prophet (SAW), the prophet (SAW) at Madinah, the mosque, the charter of Madinah
7. The battle of badr, The battle of uhud, hudaibiyah agreement, the conquest of Makkah, The Hajj, The farewell address, the sad news.

#### **Recommended Books:**

1. Gulam Sarwar - "ISLAM (Beliefs & Teachings)"
2. Mohammed Mahbubur Rahman- The Ideal Life of the Prophet (SAW)
3. M. Watt- Muhammad at Macca and Muhammad at Madina
4. Wahiduddin Khan- Muhammad the Revolution
5. Saiyid Sulaiman Nadwi- Muhammad the Ideal prophet: A historical, practical, perfect model for humanity.

### **Pharm-3601: Medicinal Chemistry –II:**

Credit Hours: 3

Contact Hours: 4 per week

1. **Medicinal Chemistry:** History, purpose, medicinal uses of drugs, place of drug synthesis, pharmacodynamic agents, dietary factors in medicine, future economics of medicinal drugs and application of computer in medicinal chemistry.
2. **Molecular basis of drug action:** Action of drug on the basis of receptor, specific and nonspecific receptors, action of drugs not mediated by receptor, factors affecting drug-receptor interaction, nature of drug-receptor interaction, role of receptor in the design of new drugs. The molecular aspect of drug receptor interaction : (a) narcotic analgesics and antagonists, (b) sulfadugs, (c) enzyme inhibitors, (d) H<sub>1</sub> and H<sub>2</sub> blockers, (e) adrenergic blockers, (f) benzodiazepine derivatives.

**3. Stereochemistry:**

- a) Geometric isomerism of alkenes and cyclic compounds, cis, trans and (E), (Z) systems of nomenclature.
- b) Conformational isomers, conformation of open chain and cyclic compounds.
- c) Chirality of molecules, enantiomer, diastereomer, racemic modification, meso compound, (R) and (S) configuration, sequence rule, and optical rotation.
- d) Stereo-selective and stereo specific reaction.
- e) Pharmaceutical importance of stereochemistry study.

**4. Principle of drug design**, theory, different traditional mechanism based approaches to drug design, computer assisted drug designing (CADD)**Recommended Books:**

1. Patrick - Introduction to Medicinal Chemistry
2. Wilson, Gisvold's - Textbook of Organic Medicinal and Pharmaceutical Chemistry
3. Block- Inorganic, Medicinal and Pharmaceutical Chemistry
4. Ariens- Drug Design
5. Goldstein- Principle of Drug Design
6. Burger- Medicinal Chemistry and Drug Discovery
7. W. O Foye- Medicinal Chemistry

**Pharm-3602 : Medicinal Chemistry –II Lab:**

Credit Hour: 1

Contact Hours: 3 per week

Synthesis of drug &amp; drug intermediates

- a) Paracetamol
- b) Benzocaine
- c) Aspirin
- d) Phenacetin
- e) PABA

**Pharm-3603: Biopharmaceutics & Pharmacokinetics-II:**

Credit Hours: 2

Contact Hours: 4 per week

**1. Compartmental Analysis:**

- a) One compartment open model, determination of plasma concentration from one compartment open model, calculation of apparent volume of distribution, calculation of K from urinary excretion data.
- b) Multiple-compartment models: i) Two compartment open model: method of residuals, apparent volumes of distributions, 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.

**1. 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.**2. Drug product selection on the basis of bioavailability testing.**

**Recommended Books:**

1. Leon Shargel - Applied Biopharmaceutics and Pharmacokinetics
2. Gibaldi- Biopharmaceutics and Clinical Pharmacokinetics
3. Bourne- Pharmacokinetics
4. Cadwallader- Biopharmaceutics
5. Heremath- Textbook of Biopharmaceutics

**Pharm-3604 : Biopharmaceutics & Pharmacokinetics-II Lab:**

Credit Hours: 1

Contact Hours: 3 per week

1. Dissolution study of the conventional paracetamol tablet.
2. Dissolution study of the conventional ibuprofen tablet.
3. Dissolution study of paracetamol from combined dosage form.
4. Dissolution study of sulfamethoxazole from cotrim tablet.

**Pharm-3605: Pharmaceutical Analysis-II:**

Credit Hours: 3

Contact Hours: 4 per week

**1. Spectroscopy:**

- i. Nuclear magnetic resonance spectroscopy ( $^1\text{H}$  NMR and  $^{13}\text{C}$  NMR): Introduction, instrumentation and application.
- ii. Mass spectroscopy: Introduction, instrumentation, and interpretation of spectra, mass spectrometry in pharmacy.
- iii. Atomic absorption spectroscopy.
- iv. Advanced UV-IR studies in structure elucidation.
- v. Chemical crystallography X-ray and diffraction of X-ray by crystals, Bragg's law, powder diffraction pattern, methods of measurement and analytical application of x-ray diffraction.

**2. Electrochemical methods:**

- a. Electrogravimetric analysis: Theory of electroanalysis, polarization, decomposition, potential and over voltage electrolytic determination at constant current and with controlled potential at the cathode.
- b. Conductometry: Apparatus, measurements, experimental details of conductometric titration and applications.
- c. Potentiometry: Principles, methods and applications.
- d. Amperometry: Theory and technique of amperometric titration with dropping mercury electrode, high frequency titration, its applications.
- e. Polarographic analysis: Introduction, principles, diffusion current and half wave potential, quantitative techniques.

**3. Microbiological Assays:**

Bioassay, special problems in the development of biological assays, errors in bioassay and methods to avoid them, prerequisites of biological assay, statistical design & analysis of bioavailability / bioassay.

**4. Chromatography:** Introduction, principles, theoretical consideration of TLC, HPTLC, HPLC, column technology, detectors, analytical application of TLC and HPLC.

**Recommended Books:**

1. Leslie G Chatten- Pharmaceutical Chemistry vol.1
2. Vogel- Quantitative Analysis
3. Willard- Instrumental Methods of Analysis
4. Braun- Instrumental Analysis
5. P. D. Sethi- Quantitative Analysis of Drugs in Pharmaceutical Formulations
6. Anees Md. Siddiqui- Practical Pharmaceutical Chemistry
7. WHO- Basic Tests of Pharmaceuticals

**Pharm-3606: Pharmaceutical Analysis-II Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Determination of Fe (II) ion in Mohr's salt solution by the titration with dilute  $KMnO_4$  solution.
2. Analysis of Cu (II) solution idiometrically.

**Pharm-3607: Pharmaceutical Engineering-I:**

Credit Hours: 3

Contact Hours: 3 per week

- 1.**Drying:** Definition, importance of drying, theory & fundamental concepts, periods of drying, constant rate period, falling rate period, critical moisture content, equilibrium moisture content, classification : direct, indirect, radiation, dielectric, batch and continuous, dryers, types of beds: static, moving, fluidized, pneumatic bed systems, different drying equipments(construction, operation, merits, demerits): tray dryer, through-circulation dryer, pneumatic conveying dryer, rotary dryer, spray dryer, tunnel dryer, steam tube rotary dryer, agitated pan dryer, vacuum rotary dryer and freeze dryer, selection of drying equipment, preliminary dryer selection, drying tests, final selection.
- 2.**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 and 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 equipment.
- 3.**Centrifuges:** General principles, magnitude of centrifugal force, materials of construction, critical speed, sedimentation centrifuges, filtering centrifugal, centrifuge auxiliaries, drive mechanisms, feed and discharge lines, feed treatment, selection of centrifugal separators.

4. **Sterilization:** Principle of sterilization, classification, factors affecting thermal sterilization, sterilization by heat, gas, radiation and filtration, aseptic technique and sterility testing.

### **Recommended Books:**

1. Lachman, Lieberman, King- The Theory and Practice of Industrial Pharmacy
2. Remington's Pharmaceuticals Sciences
3. H A Liberman- Pharmaceutical Dosages form
4. Ansel - Dosages form Design
5. Perry- Chemical Engineer's Handbook
6. Carsteinsen- Drug Stability
7. PN. Ananthanarayan- Basic Refrigeration and Air Conditioning
8. Bentley's Text book of Pharmaceutics
9. Gupta- Introduction to Pharmaceutics

### **Pharm-3608 : Pharmaceutical Engineering-I Lab:**

Credit Hour: 1

Contact Hours: 3 per week

- I) Tablet & Capsule weight variation test.
- II) Tablet friability test.
- III) Leakage test of packaging of tablets/capsules.
- IV) Formulation and compounding of ointments.
- V) Formulation and manufacturing of antihistamine tablets.
- VI) Formulation and manufacturing of dispersible aspirin tablet.

### **Pharm-3609: Pharmaceutical Regulatory Affairs:**

Credit Hours: 3

Contact Hours: 3 per week

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: The Drug Act 1940, The Poisons Act 1919 and related amendments, The drug ordinance 1982, The Drug Policy 1982, The Drug (control) ordinance 1982, The Narcotics (control) Act 1990, The drug policy 2006
3. Approval process, format and registration of pharmaceuticals in Bangladesh.
4. Rules and regulations for controlling poisons and narcotic materials in Bangladesh.
5. Control of drug advertisements and prices, patented and trade marked medicine, proprietary medicine, regulation of cosmetics and poison control.
6. Drug authority of Bangladesh: Functions and activities of Directorate of Drug registration methods in Bangladesh, Technical committee and Drug Control committee (DCC).

7. Rational Use of Drugs: Definition, background, factors underlying of irrational use of drugs, impact of irrational drug use, drug supply system, drug use pattern of develop and developing countries, situation in Bangladesh, INRUD
8. Forensic Pharmacy: Definition, epidemiology of poisoning, influential factors, substance most frequently involved in accidental ingestions among children, first-aid treatment for poisoning, antidotes: Locally acting and systemic, prevention of poisoning, poison treatment centers, schedules of drugs and poison, poison prevention packaging, role of pharmacist at different level.

**Recommended Books:**

1. Remington's Pharmaceuticals Sciences
2. Mithal- Forensic Pharmacy
3. Dale- Pharmacy law and ethics

**Pharm-3613: Oral Assessment-III.**

Credit Hour: 1

Contact Hour: 1 per week

## 7<sup>th</sup> Semester

### **URIH-4701: A Survey of Islamic History**

Credit Hours: 1

Contact Hours: 1 per week

The objective of this course is to create awareness among the students about the importance of studying history with special reference to the study of Islamic History. This course also aims at making the students acquainted with the glorious contribution of the Pious Caliphs and their successors towards the development of just administration advancement of civilization and education and their great services towards humanity at large.

Definition of history and islamic history: kinds of history, importance of history, sources of islamic history. Study of islamic history in Bangladesh.

1. **Khilafat:** Definition, origin and development of khilafat - Difference between khilafat in general sense and khilafat ala-minhaj - an nubuwwat - election to the office of the khilafat - khilafat vs mulukiyyat - end of khilafat,
2. **Introduction to Pious Khilafat:** The Shura - civil administration - sources of revenue - Bait-al- Mal - judicial administration - police - prison - religious administration and military administration under Pious Caliphs, character and achievements of the Pious Caliphs.
3. **The Ummayyad Khilafat:** Conquest and expansion of islamic empire. Umar bin Abdul Aziz and his administrative policies - central and provincial administration - social condition - Ummayyad's contribution towards the development of civilization & education - fall of the Ummayyads.
4. **The Abbasid Khilafat:** Golden prime of the Abbasids - Abbasid society - scientific and literary development - education - development of art & architecture - civil, military, judicial and revenue administration under the Abbasids.
5. **Status** of women & non-muslim citizens in islamic society, during the period of Kulafa-e-Rashideen and the Ummayyad and Abbasid Khilafat.

#### **Recommended Books:**

1. P.K.Hitti : "History of the Arabs"
2. K.Ali : "Study of Islamic History"
3. SAQ Hussani : "Arab Administration"

### **Pharm-4701: Pharmaceutical Engineering-II:**

Credit Hours: 3

Contact Hours: 3 per week

**1. Solid-Solid Mixing:** Importance, fundamentals, batch homogeneity, 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.

**2. Paste Mixing:** Definition, importance, simple blending, dispersion operations and 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, selection of process and mixer.

**3. Liquid Mixing:** Definition, importance, mixing equipment, axial and radial flow impellers, mechanisms, flow patterns, impellers, fiat -blade and curved 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, selection of impeller.

**4. Milling:** Definition, application and limitations, factors affecting milling operation, mechanisms of size reduction process, methods of size reduction by cutter mill, roller mill, hammer mill, ball mill, vibration mill, edge runner mill, end runner mill, fluid energy mill, hand mill, colloid mill (principle, design, operation and advantages) and selection of a mill.

**5. Air Conditioning, Refrigeration & Humidity Control:**

- a) Air conditioning: Definition, importance, pharmaceutical application, differences between air conditioner & air cooler, comfort zone, different types of air conditioners, selection of an air conditioner, design of an air conditioned room, pharmaceuticals needing air conditioning.
- b) Refrigeration: Definition, pharmaceutical application, refrigerators design, mechanism of cooling, refrigerants, brine selection, pharmaceuticals needing refrigerated storage.
- c) Humidity control: Terminology (psychometry, absolute humidity, relative humidity, dew point, humid heat, humid volume, wet bulb temperature and adiabatic saturation temperature), relationship between wet bulb and adiabatic saturation temperatures, humidifier, dehumidifier, uses of psychometric charts, measurement of humidity and applications of humidity control.

**6. Lay out plan of pharmaceutical manufacturing plant:** Guidelines for selecting new plant sites, pharmaceutical lay out plan and design, criteria for production facilities.

**Recommended Books:**

1. Lachman, Lieberman, King- The Theory and Practice of Industrial Pharmacy
2. Remington's Pharmaceuticals Sciences
3. H A Liberman- Pharmaceutical Dosages Form
4. Ansel - Dosages Form Design

5. Perry- Chemical Engineer's Handbook
6. Carsteinsen- Drug Stability
7. PN. Ananthanarayan- Basic Refrigeration and Air Conditioning
8. Bentley's Text Book of Pharmaceutics
9. Gupta- Introduction to Pharmaceutics

**Pharm-4702: Pharmaceutical Engineering-II Lab:**

Credit Hour: 1

Contact Hour: 3 per week

1. Formulation and manufacturing of antihistamine tablets.
2. Formulation and manufacturing of dispersible aspirin tablet.
3. Preparation of granules and rheological studies
4. Study of different compounds of a 16- station rotary tablet press.

**Pharm-4703: Medicinal Chemistry-III**

Credit Hours: 3

Contact Hours: 3 per week

**1. Drug Design and Discovery:**

- a) Sources of drugs, cost and place of development of drugs, search for new drugs, genesis of drugs.
- b) Antihypertensive drugs,  $\beta$ -blocker, H<sub>2</sub>-blockers, semisynthetic penicillins, quinolone derivatives and antidiabetic drugs.
- c) Role of biological half life ( $t_{1/2}$ ), metabolism of drug as drug design.

**2. Chemistry, Uses and SAR of the Following Drugs:**

- a) Psychotropic drugs, b) Antidepressant drugs and c) Antineoplastic drugs.

**3. Chemistry, Synthesis And Therapeutic Uses Of The Following Drugs:**

- (i) Psychotropic drugs: TCA compounds, MAOIs, phenothiazine derivatives.
- (ii) Antineoplastic drugs: Alkylating agents, antimetabolites, plant products.
- (iii) Sedatives & Hypnotic agents: Benzodiazepines, barbiturates.
- (iv) Antihistaminics: H<sub>1</sub> and H<sub>2</sub> antagonists.
- (v) NSAIDs : Indomethacin, ibuprofen, naproxen and probenecid.
- (vi) Antipyretic and analgesics: Phenacetin, phenylbutazone, mefenamic acid.
- (vii) Cardiovascular Drugs: Hydralazine, propranolol, procainamide, prenylamine.
- (viii) Local Anaesthetics : Benzocaine, procaine , lignocaine.
- (ix) Antimalarials: Chloroquine, pamaquine, trimethoprim.
- (x) Diuretics: Chlorothiazide, acetazolamide, triamterene.
- (xi) Non-steroidal oestrogens: Stilbesterol, hexestrol, dienestrol.

**4. A Knowledge of Chemistry (Including Synthesis) and Structure Activity Relationship of The Following Groups Of Medicinal Substances: Hypnotics and**

sedatives, analgesics, anti-histaminics and tranquilizing agents, Psychotropic drug, antidepressant drug and antineoplastic drug.

### Recommended Books:

1. Patrick - A Introduction to Medicinal Chemistry
2. Wilson , Gisvold's : Textbook of Organic Medicinal and Pharmaceutical Chemistry
3. A Kar - Medicinal Chemistry
4. Pimaroo- Textbook of Medicinal Chemistry
5. Burger- Medicinal Chemistry and Drug Discovery

### Pharm-4704: Medicinal Chemistry-III Lab

Credit Hour: 1

Contact Hour: 3 per week

Synthesis of following drugs and drug intermediates:

- a) PABA (Para amino-benzoic acid )
- b) Meta nitro-benzaldehyde
- c) Ethyl para hydroxy-benzoate
- d) Para amino phenol
- e) Methyl salicylate.

### Pharm-4705: Clinical Pharmacy

Credit Hours: 3

Contact Hours: 3 per week

1. **Introduction:** Clinic, hospital, clinical pharmacy, scope, importance and application of clinical pharmacy, diagnosis & routine tests for diagnosis, enzyme, coenzyme & isoenzyme and their role in diagnosis of disease, pharmacokinetics of few drugs.
2. **Drug Abuse:** drug addiction, drug habituation, drug dependence and drawbacks of self- medication.
3. **Clinical Chemistry & Interpretation of Clinical Laboratory Tests**
  - i) Blood chemistry, ii) Hematology and iii) Urinalysis
4. **Clinical Interpretation of Pathophysiology of the Following Diseases**
  - i) Diabetes, ii) Essential hypertension, iii) Anaemia, iv) AIDS v) Tuberculosis, vi) Peptic ulcer and vii) Venereal diseases, viii) UTI, ix) RTI, etc.
5. **Clinical Toxicology:** Poisons, toxins of animal origin, role of poison centers, adverse reactions and poisoning incidences, analysis of poisoning situations, sources and assessment of poison exposure, over doses of drugs and drug interactions, symptoms and management of poisoning cases with pesticides, fumigants, solvents, vapors, food toxins and cyanides.

**6. Pathology:**

- a) Definition and scope of pathology.
- b) Pathological calcification
- c) Name, definition and examination of all common pathological tests and the standard values.

**Recommended Books:**

1. Herfindal, Gourley, Lioyd H : Clinical Pharmacy and Therapeutics
2. Nand, Khar- Hospital and Clinical Pharmacy
3. Dandiya and Mathur- Hospital and Clinical Pharmacy
4. Anees Ahmad- Hospital and Clinical Pharmacy

**Pharm-4706 : Clinical Pharmacy Lab:**

Credit Hour: 1

Contact Hours: 3 per week

Experiments on Clinical Laboratory Tests of Different Diseases-

1. Billirubin test for jaundice
2. Blood glucose level for diabetes.
3. Pus cell in urine for UTI.
4. Inulin clearance test for kidney diseases.

**Pharm-4707: Pharmaceutical Marketing & Management**

Credit Hours: 3

Contact Hours: 3 per week

**1. Personnel Management:**

- a) Definition, scope, importance, behavioral science and personnel management.
- b) Motivation, moral and job satisfaction.
- c) Education, training, management development and performance evaluation.
- d) Means of achieving harmonious industrial relation collective bargaining, joint consultation worker council, arbitration, and industrial democracy.

**2. Production Management:** Definition, scope, importance and application of management, techniques and principles to production management, production planning and quality control.

**3. Materials Management:**

- a) Purchasing: Formulating effective buying policies, determination of needs and desires of patrons, selecting the sources of supply, determination the terms of purchase, receiving, marketing and stocking goods.
- b) Inventory control: Methods of inventory control, selection of optimum method, effect of inventory control.

**4. Pharmaceutical Marketing:**

- a) Promotion: Objectives, classification, developing a promotional plan, promotion strategy, budget and executing the program, steps of implantation of advertising,

types (display, direct mail, etc.) and preparation of advertisement. personal selling and evaluation of promotion (general and specialized method).

- b) Pricing: General consideration, pricing method, prescription pricing and professional fees.
  - c) Channel of distribution
  - d) Forecasting of sales
5. Management of Community Pharmacy and Governmental Pharmacy.

### **Recommended Books:**

1. Kotler - Marketing Management
2. K C Jain - Fundamental of Management
3. K. C Jain- Production Planning Control and Industrial Management
4. Ashok K. Gupta- Drug Store and Business Management

### **Pharm-4709: Pharmaceutical Quality Assurance:**

Credit Hours: 3

Contact Hours: 3 per week

- 1. Introduction:** Importance of pharmaceutical quality assurance, sources of quality variation, control of quality variation, set up of a quality control laboratory for pharmaceutical analysis, personnel, equipment, environments, etc. Types of specifications, testing program and methods.
- 2. In Process Quality Assurance Method:** Concept of quality assurance, selection and testing of major raw materials input. Methods of drug sampling, statistical quality control of major categories of dosage forms, QA activities, GMP.
- 3. Pharmaceutical Validation Concept:** Validating process and equipment, advantages of validation.
- 4. Management of Quality Assurance:** Quality management consideration, quality motivation, total quality management.
- 5. Policies for Quality Assurance:** International standard organization and BSTI (DA) policies for quality in pharmaceutical industries.
- 6. Concept of Statistical Quality Control:** Normal frequency distribution, Q.C. charts, sampling and sampling plan, binomial distribution, tests of significance, consumer acceptance testing, analysis of variance (ANOVA) and experimental design, bio-availability and crossover design, regression correlation, Wilcoxon rank sum test.

### **Recommended Books:**

1. Shah N Khan - Pharmaceutical Quality Assurance
2. Hitashi Kume- Statistical Methods for Quality Improvement
3. Hitashi Kume- Management by Quality
4. Lim Tew Ek- Quality Management System
5. Shah Newaz- Assurance of Quality Pharmaceuticals

## 8<sup>th</sup> Semester

### **URBS-4802: Bangladesh Studies**

Credit Hours: 2

Contact Hours: 2 per week

The objectives of this study is to create awareness among the students about the history, geography, economics, sociology, politics, language, literature, philosophy, art and culture of Bangladesh and such other subjects as are significantly related to the life and society of Bangladesh.

1. Introduction to the course and its objectives.
2. Outline of geography of Bangladesh.
3. Advent of Islam in Bengal and the muslim conquest: Its impact on the people - Origin of the muslims of Bengal (formation of muslim society under the Bengal sultanate, Impact of Sufism in Bengal) (reform movements) educational development under the muslims, the British policy towards the education: a brief discussion of struggle for freedom from the British colonialism development of Bengali prose literature (new trend of nationalism) creation of Pakistan and the emergence of Bangladesh.
4. Political development in Bangladesh: Political parties & constitutional development.
5. Economic condition of Bangladesh socio-cultural problems and prospects of Bangladesh.

#### **Recommended Books:**

Prof. Dr. Mohar AH	: History of Muslims in Bengal
Prof. Rounaque Jahan	: Bangladesh Politics: Problems & Issues
Prof. G. W. Chowdhury	: The Last Days of Pakistan
Banglapedia (National Encyclopedia of Bangladesh)	

### **Pharm-4801: Biopharmaceutics & Pharmacokinetics-III:**

Credit Hours: 3

Contact Hours: 4 per week

- 1. Pharmacokinetics of Drug Absorption:** Zero order absorption models, first order absorption model ,determination of absorption rate constants from oral absorption data, method of residuals, Wagner Nelson method, determination of  $k_a$  from two compartment oral absorption data, Loo Riegelman method.
- 2. Multiple Doses Regimens (MDR):** Drug accumulation, repetitive intravenous injection, multiple oral doses regimens, loading dose and determination of bioavailability and bio- equivalency from MDR.
- 3. Intravenous Infusion:** One compartment model drugs, two compartment model drugs, infusion plus loading dose.

**4. Dose Adjustment in Renal Diseases:**

- a) Pharmacokinetic considerations, general approaches for dose adjustment in renal disease, dose adjustment based on drug clearance, method based on changes in the elimination rate constant, measurement of glomerular filtration rate (GER), calculation of creatinine clearance from serum creatinine concentration, dose adjustment based on monogram, Giusti-Hayton method, Wagner method.
- b) Extracorporeal removal of drugs, dialysis.

**5.** Non-compartmental analysis, physiologic-pharmacokinetic model, statistical moment, means residence time etc.

**Recommended Books:**

1. Leon Shargel- Applied Biopharmaceutics and Pharmacokinetics
2. Rowland- Clinical Pharmacokinetics
3. Notari- Biopharmaceutics and Clinical Pharmacokinetics
4. Lachman- Theory and Practice of Industrial Pharmacy
5. Griffin- Drug Interaction
6. Gibaldi- Biopharmaceutics and Clinical Pharmacokinetics

**Pharm-4802: Biopharmaceutics & Pharmacokinetics-III Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Dissolution study of the conventional diclofenac sodium tablet.
2. Dissolution study of the sustained release diclofenac sodium tablet.
3. Dissolution study of the suppository.

**Pharm-4803: Hospital & Community Pharmacy:**

Credit Hours: 3

Contact Hours: 3 per week

**A. Hospital Pharmacy:**

1. **Introduction:** Goals, minimum standards, abilities required for a hospital pharmacist. Hospital as an organization, classification, organizational patterns, management and administration, different departments and services, role of a pharmacist in the hospital. Hospital pharmacy, organizational and personnel, supportive personnel, pharmacy education, job descriptions.
2. **Pharmacy and Therapeutics Committee:** Description and purpose, membership and functions. Hospital formulary, guiding principles, legal basis, principles for admission or deletion of drugs, selection of text.
3. **Investigational Use of Drugs:** Description, principles involved, classification, control, identification, role of hospital pharmacist, advisory committee.

4. **Purchasing and Inventory Control:** Purchasing agent, purchasing procedure, control on purchases, storage, perishable inventory, physical inventory, perpetual inventory.
5. **Control of Special Classes of Drugs:** Use of samples, in-patient drug orders, out-patient prescriptions, ward stock drugs, label symbols.  
Narcotics and their control, classes, procurement and execution of order forms, dispensing, hospital narcotic regulations, new systems.  
Floor stock drugs, selection, charge and non-charge, labeling, regulations concerning narcotics, inspection of nursing drug cabinets.
6. **Dispensing to in-and Out Patients:** Drug distribution systems, dispensing of charge, non- floor stock drugs, mobile dispensing unit, unit dose dispensing.  
Dispensing to out patients, locality of out-patient dispensing area, dispensing routine, record keeping. Dispensing during off-hours, use of nursing supervisors, emergency boxes and night drug cabinets, pharmacist-on-call.  
Drug charges in hospitals, pricing and break- even point pricing.
7. **Manufacturing-Bulk and Sterile:** Control and budget, manufacturing facility and capacity, operating costs, quality control.
8. **Drug Information Centre and Library:** Physical facilities, selection of contents, methods of dissemination, role in educational and training programs, professional education, internal teaching programs, external teaching programs.

**B. Community Pharmacy:**

Concept of community health care, health needs of the community, different levels of health care, elements of primary health care, principles of primary health care: equitable distribution, community participation, intersectoral coordination, appropriate technology, health manpower, health care delivery at different levels, community pharmacy in dealing with communicable diseases problem, nutritional problems, environmental sanitation problems and indigenous systems of medicine, development of community pharmacy infrastructure, participation of non-governmental voluntary health agencies.

**Recommended Books:**

1. Remington's Pharmaceuticals Sciences
2. Cooper Gunn- Tutorial Pharmacy
3. Allwood- Hospital Pharmacy
4. Hassan- Hospital Pharmacy
5. Gupta- Health Education and Community Pharmacy
6. Agarwal and Khanna- Dispensing and Community Pharmacy

**Pharm-4805: Toxicology:**

Credit Hours: 2

Contact Hours: 2 per week

**1. General Principles:**

Introduction, general management of poisoning, diagnosis of poisoning, duties of the doctor in a case of poisoning

2. **Corrosive Poisons:**  
Mineral acids (inorganic acids), organic acids, alkalies
3. **Irritant Poisons:**  
Inorganic irritants, non-metallic irritants, metallic irritants organic irritants, irritants of plant origin, irritants of animal origin mechanical irritants.
4. **Neurotoxic Poisons:**  
Cerebral poisons, somniferous group, inebriant group, deliriant Group, psychotropic group, spinal poisons peripheral neurotoxic poisons.
5. **Cardiovascular Poisons:**  
Antihypertensive anticoagulants, cardiotoxic poisons
6. **Asphyxiant Poisons**
7. **Miscellaneous Poisons:**  
Antipyretics, non-steroidal anti-inflammatory drugs, antihistamines, anti-infectives, anti-tubercular and anti-leprosy drugs, hypoglycemic agents, food poisons, odds and ends.
8. **Obstetric and Pediatric Considerations:**  
Poisoning and pregnancy pediatric toxicology

### **Recommended Books:**

1. VV Pilly- Modern Medical Toxicology
2. Timbrell- Biochemical Toxicology
3. Loomis, T. A. – Essentials of Toxicology
4. Merck Index of Chemicals and Drugs
5. Remington's Pharmaceutical Sciences

### **Pharm-4807: Cosmetology:**

Credit Hours: 2

Contact Hours: 3 per week

1. **The skin:** Introduction, epidermis and keratinizing system, pigmentary system, Langerhans cell, dermis, nerves and sense organs, blood vessels, exocrine sweat glands, hair follicles, sebaceous glands, apocrine glands, common disorders of the skin.
2. **Skin creams:** Introduction, classification of skin creams, cold cream, vanishing creams, emollient cream and lotion.
3. **Shaving preparations:** Introduction, lather shaving cream, brushes less or non-lathering cream, aerosol shaving foams, after shave preparations.
4. **Dental products:** Introduction, formulation and manufacture of toothpastes, tooth powder and mouthwash.

5. **Hair products:** Introduction, shampoos, hair setting lotions, hair tonic and conditioners etc.
6. **Brief study on deodorant:** Talcum powder, perfume, etc.
7. **Lip-products:** Lip stick, chap stick etc.

**Recommended Books:**

1. Balsam - Cosmetology
2. Harry- Cosmetology
3. Simmons- The Science of Cosmetics
4. Nigel Groom- The Perfume Handbook

**Pharm-4808: Cosmetology Lab:**

Credit Hour: 1

Contact Hours: 3 per week

1. Preparation of shaving lotion.
2. Preparation of cold cream.
3. Preparation of vanishing cream.
4. Preparation of egg shampoo.
5. Preparation of antidandruff shampoo.

**Pharm-4809: Practical training ( Inplant training)**

Credit hour- 0

**Pharm-4813: Oral Assessment-IV.**

Credit Hours: 1

Contact Hour: 1 per week

**Pharm-4814: Project**

Credit Hours: 2

Contact Hour: 1 per week