



Bachelor of Pharmaceutical Sciences (B. Pharm.)

Syllabus

**THE SCHOOL OF PHARMACEUTICAL AND BIOMEDICAL SCIENCES
FACULTY OF SCIENCE AND TECHNOLOGY
POKHARA UNIVERSITY**
www.pu.edu.np

2005

BACHELOR OF PHARMACEUTICAL SCIENCES (B. PHARM.) PROGRAM

GOAL AND FOCUS

The School of Pharmaceutical and Biomedical Sciences is being established at the beginning of this century under Pokhara University, Pokhara by the common efforts of educators, parents, students, and benefactors it aims for a new standard in pharmaceutical education to meet the challenges of health of the 21st century. The School is expecting to produce highly qualified graduates and subsequently to promote research excellence in a free and scholastic environment.

The University has prepared its curriculum emphasizing on

- Himalayan medicinal resources
- Clinical pharmacy education.

The School of Pharmaceutical and biomedical Sciences has but one goal – to make students able to appreciate the sanctity of life and flush them with a pioneering spirit, that enable them to make a valuable contribution to medical treatment and people's health.

OBJECTIVES

The course of Pharmaceutical Sciences for B. Pharm. is designed to achieve the following objectives to:

- provide adequate educational background for rewarding careers in pharmacy profession.
- study and strengthen the existing pharmacy practices in the private and public sector organizations through continuing education and training programs.
- assist pharmaceutical and related organizations in solving their problems by providing consultancy services.
- contribute to pharmacy literature relevant to Nepal through research and publications.

CAREER OPPORTUNITY

The role of the Pharmacists is expanding day by day. On the other hand, the number of Pharmacists in Nepal is quite limited. Therefore, there is a great employment opportunity for the Pharmacists within Nepal or in foreign countries. In general, a Pharmacist can choose following area to build the career.

- University (Education and Research)
- Pharmaceutical Industry
- Pharmacy (retail pharmacy)
- Hospital
- Governmental Drug Administration
- Drug Research Laboratory
- Health Research Council
- Adverse Drug Reaction Monitoring Service
- Health Food Development
- Natural Medicine Resource Development

AN INTRODUCTION TO B. PHARM. PROGRAM

A. GENERAL

1. Title

The title of the program is Bachelor of Pharmaceutical Sciences (B. Pharm.).

2. Objective

The objective of the B. Pharm. program is to produce a highly qualified pharmacist.

3. Location

Presently, all classes will be held in The School of Pharmaceutical and Biomedical Sciences, Pokhara University located at Simalchaur, Pokhara.

4. Course Structure

- The B. Pharm. course comprises of 19 credit hours in first semester, 15 credit hours in last semester and 22 credit hours in all other semesters with the total of 166 credit hours spreading over eight semesters.
- Three credit hours of theory is equivalent to 45 hours lecture in one semester. One credit of practical involves at least three hours practical work per week.
- All theory courses will be of three credit hours and all practical and seminars will be of one credit hour. The pharmacy practice will be of three credit hours. Project works will be of ten credit hours.
- An average involvement of a student in University will be of 6 h/day, i. e. 36 h/week (Sunday to Friday). Approximate active weeks will be of 16 weeks/semester and therefore, in total, the student will be engaged more than 540 h/semester.
- Each theory class will be of 55 minutes and after two continuous theory classes there will be a break of 15 minutes. Each practical and seminar classes will be of minimum three hours.
- Subject Code will be as follow:
 - 0 PHT = Pharmaceutics, related subjects and Pharmacy Practice
 - 1 PHL = Pharmacology,
 - 2 BCM = Biochemistry
 - 3 APL = Anatomy and Physiology
 - 4 CBL = Molecular Cell Biology
 - 5 MBL = Microbiology

- 6 IML = Immunology
- 7 PHC = Pharmaceutical Chemistry and Medicinal Chemistry
- 8 PHG = Pharmacognosy
- 9 Others = Mathematics (MTH), English (ENG), Computer Science (CSC) Research (RES) and Project Work (PRW)

5. Course Coding

Each course is identified by three capital letters followed by three digits. Three letters indicate the subject area (e.g., PHT for pharmaceuticals, MTH for mathematics etc). The first digit of each number indicates the academic year of the course (1 for first year, 2 for second year and so on). The second digit indicates subject (*see* subject code in structure), and the third digit indicates the sequence.

6. Normal and Maximum Duration of Stay in the University

The normal duration for completing the B. Pharm. course is four years. In exceptional case, however, the student is allowed normal duration plus two years to complete the course. If a student is unable to complete the course within six years from the time of admission, the University registration is annulled.

7. Academic Schedule

The academic session consists of two semesters per year. Generally the Fall Semester (September - February) starts in September and the Spring Semester (February - August) begins in February, however it may differ slightly in any particular year.

8. Medium of Teaching and Examination

The medium of instruction and examination for B. Pharm. program will be English.

9. Special Seminar

Scientists/professionals of national or international repute will be invited to deliver special seminar.

10. Other

All other rules and regulations will be followed as already established by Pokhara University.

B. ADMISSION AND EXAMINATION

1. Entry Requirement for New Student

The entry requirement for a new student in B. Pharm. will be Intermediate in Science (I. Sc.) or Higher Secondary level (10+2, Science Stream) or Proficiency Certificate Level (PCL, Science), or equivalent as recognized by Pokhara University with more than 50% marks. Besides the basic academic requirement, an entrance examination will be held for all applicants.

2. Admission Procedure

The application form and the information can be obtained on request from The School of Pharmaceutical and Biomedical Sciences, Pokhara University, Pokhara or Contact Office of Pokhara University, Kathmandu. Only the eligible candidates will be allowed to take part in the entrance test.

The subjects in the entrance test will be Chemistry, Biology, Mathematics, and English according to the syllabus of grade 11 and 12 levels. The University may also hold interviews for the candidates before their final selection for admission. The candidates will be admitted on merit basis. Eligible foreign national students may be admitted against limited seats on the basis of an interview.

The candidates, who are given provisional admission under special condition, are required to submit all necessary documents within a month of the beginning of regular classes. Otherwise, the admission will be annulled.

3. Student Evaluation

The student's academic performance during a semester will be evaluated internally (sessional work) and externally (the final examination). The sessional work examination will be evaluated by the teaching Faculty and it will be of 50% weight. The remaining 50% will be the final examination, conducted by University.

In the Practical courses, no final examination will be conducted and the sessional marks shall be awarded on the basis of internal assessment.

To pass a particular course, a student must obtain a minimum of D grade in sessional work (average of internal assessments) and the final examination, separately.

4. Attendance Requirement

The students must attend every lecture, tutorial, seminar and practical classes. However, to accommodate for sickness and other contingencies, the attendance

requirement shall be a minimum of 80% of the classes in any particular subject, otherwise s/he shall not be allowed to take the final examination in that subject. If a student is continuously absent in the class for more than four weeks without notifying the authorities, his/her name will be removed from the school roll.

5. Course Registration

The academic record of a student shall be maintained in terms of the courses for which s/he registers in any semester, and the grades s/he obtains in those courses. Registration for courses is done at the beginning of each semester. Since registration is a very important procedural part of the credit system, it is absolutely essential that all students present themselves at the school. In case of illness or any exceptional circumstance during the registration period, the student must inform the University authority. Registration absentia may be allowed only in rare cases, at the discretion of the authorized person. However, the student's nominee cannot register for courses and will only be allowed to complete other formalities.

Generally in a particular semester or year only those courses would be offered for registration which are mentioned in the syllabus, however their sequence may be interchanged if necessary.

6. Repeating a Course

Since passing of all courses individually is a degree requirement, the student must retake the failing core course when offered and must successfully complete the course. Retaking a course in which a student has earned a D grade is optional. Student can retake a course when one receives GPA less than 2.0. The grade earned on the retake will be substituted for the grade earned previously.

7. Transfer of Credit Hours

A maximum up to 25% of the total credit hours of course completed in an equivalent program of a recognized institution may be transferred/waived for credit on the recommendation of the head of the faculty. For transfer of credit, a student must have received a grade of B or better in respective course. Courses taken earlier than five years from the time of transfer may not be accepted for transfer of credit. However, a student transferring from one program to another program of Pokhara University may receive a credit transfer of all the compatible courses completed with at least grade C.

The concerned Subject Committee of the University will make an evaluation of the applicant for transfer of credit. The awarding of transferred credit will be based on the applicant's score in the University, which s/he has attended previously.

8. Final Examination

University conducts final examination at the end of each semester. The procedure of final examination conduction will be as per the examination rules of the University.

9. Unsatisfactory Results

Students may apply for retotalling or rechecking of their grades as per University rule, upon payment of prescribed fee.

C. Grading System

The grades (marks) awarded to student in a course is based on his/her consolidated performance in sessional and final examinations. The letter grade in any particular subject is an indication of a student's relative performance in that course. The pattern of grading will be as follows:

Letter	Grade	Grade point description
A	4.0	Excellent
A-	3.7	
B+	3.3	
B	3.0	Good
B-	2.7	
C+	2.3	
C	2.0	Satisfactory
C-	1.7	
D+	1.3	
D		1.0 Minimum requirement
F	0	Failing

In unusual circumstances, the student may be awarded an incomplete grade of "I". If all the requirements are not completed within the following semester, the grade of "I" will be automatically converted to an "F". A student receiving an "I" grade does not need to register for that subject in the following semester to complete the required works.

The performance of a student in a semester will be evaluated in terms of the semester grade point average (SGPA). The student's final grade will be calculated on cumulative grade point average (CGPA).

SGPA = Total honor points earned in a semester/total number of credits registered in a semester. CGPA = Total honor points earned/total number of credits completed.

D. DIVISION EQUIVALENCE

In Pokhara University, CGPA 2.5 or more and 3.0 or more are considered as Second and First divisions, respectively.

E. DISMISSAL FROM THE PROGRAM

A student is normally expected to maintain a CGPA of 2.0. A student failing to maintain a satisfactory academic standard shall be dismissed from the program. In case a student gets less than 2.0 SGPA then in marginal cases only the Dean or the faculty can allow the student to continue his/her studies on the recommendation of program director or the subject committee.

F. Award of Degree

On completion of total 166 credits with CGPA of 2.0 or better including in theory, practical, seminar, field work, compulsory training in industry, hospital and retail pharmacy and project work, the student will be awarded a degree of Bachelor of Pharmaceutical Sciences (B. Pharm.)

G. DEGREE WITH DISTINCTION

To obtain a degree with distinction, a student must obtain CGPA 3.6 or better

H. DEAN'S LIST

The Dean's list recognizes outstanding performances of academic excellence by students. To qualify, a student must obtain a CGPA of 3.7 or better.

Note: The provisions of this document are not to be regarded as a binding contract between the University and the students. The University reserves the right to change any provisions or requirements contained in this document at any time, without pre-notification, within the students' term of residence.

CURRICULUM STRUCTURE

FIRST YEAR

FIRST SEMESTER

Code	Description	Credit hours	Pre-requisite course	Core course
PHT 101	Pharmaceutics I (Fundamentals of Pharmacy)	3	-----	☼
PHC 171	Pharmaceutical Chemistry I (General Chemistry)	3	-----	
PHC 172	Pharmaceutical Chemistry II (Stereochemistry & Reaction Mechanism)	3	-----	
CSC 191	Computer Science (Introductory)	3	-----	
MTH 192	Mathematics (Algebra, Trigonometry, Calculus)	3	-----	
ENG 193	Communication Skill (Technical English)	3	-----	
LAB-1	Pharmaceutical Laboratory 1	1	-----	
TOTAL		19		

SECOND SEMESTER

Code	Description	Credit hours	Pre-requisite course	Core course
PHT 102	Pharmaceutics II (Physical Pharmacy)	3	PHT 101	☼
BCM 121	Biochemistry I	3	-----	
APL 131	Anatomy and Physiology I	3	-----	
PHC 173	Pharmaceutical Chemistry III (General Chemistry)	3	PHC 171	
PHG 181	Pharmacognosy I (Medicinal Botany)	3	-----	☼
MTH 194	Biostatistics	3	-----	---
LAB-2	Pharmaceutical Laboratory 2	1	-----	---
LAB-3	Pharmaceutical Laboratory 3	1	-----	---
LAB-4	Pharmaceutical Laboratory 4	1	-----	---
SEM-1	Pharmaceutical Seminar-1	1	-----	---
TOTAL		22		

SECOND YEAR

THIRD SEMESTER

Code	Description	Credit hours	Pre-requisite course	Core course
PHT 201	Pharmaceutics III (Dosage forms and Formulations)	3	PHT 102	☼
BCM 221	Biochemistry II	3	BCM 121	
APL 231	Anatomy and Physiology II	3	APL 131	
CBL 241	Molecular Cell Biology (Genetic Engineering)	3	-----	---
PHC 271	Pharmaceutical Chemistry IV (Analytical Chemistry)	3	-----	☼
PHG 281	Pharmacognosy II (Spectroscopy)	3	PHC 172	☼
LAB-5	Pharmaceutical Laboratory 5	1	-----	---
LAB-6	Pharmaceutical Laboratory 6	1	-----	---
LAB-7	Pharmaceutical Laboratory 7	1	-----	---
SEM-2	Pharmaceutical Seminar-2	1	-----	---
TOTAL		22		

FOURTH SEMESTER

Code	Description	Credit hours	Pre-requisite course	Core course
PHT 202	Pharmaceutics IV (Dosage forms and Formulations)	3	PHT 201	☼
PHT 203	Pharmaceutics V (Biopharmaceutics A)	3	PHT 201	☼
MBL 251	Pharmaceutical Microbiology I (General)	3	-----	☼
IML 261	Immunology (Fundamentals of Immunology)	3	-----	---
PHC 272	Pharmaceutical Chemistry V (General Chemical Reaction)	3	PHC 172	☼
PHG 282	Pharmacognosy III (Natural Products Chemistry)	3	PHG 281	☼
LAB-8	Pharmaceutical Laboratory 8	1	-----	---
LAB-9	Pharmaceutical Laboratory 9	1	-----	---
LAB-10	Pharmaceutical Laboratory 10	1	-----	---
SEM-3	Pharmaceutical Seminar-3	1	-----	---
TOTAL		22		

THIRD YEAR

FIFTH SEMESTER

Code	Description	Credit hours	Pre-requisite course	Core course
PHT 301	Pharmaceutics VI (Biopharmaceutics B)	3	PHT 203	☼
PHT 302	Pharmaceutics VII (Pharmaceutical Engineering and Drawing)	3	-----	☼
PHL 311	Pharmacology I (Therapeutics)	3	-----	☼
APL 331	Anatomy and Physiology (Pathophysiology)	3	APL 231	☼
PHC 371	Pharmaceutical Chemistry VI (Name Reaction)	3	PHC 172	☼
PHG 381	Pharmacognosy IV (Natural Products Chemistry)	3	PHG 281	☼
LAB-11	Pharmaceutical Laboratory 11	1	-----	---
LAB-12	Pharmaceutical Laboratory 12	1	-----	---
LAB-13	Pharmaceutical Laboratory 13	1	-----	---
SEM-4	Pharmaceutical Seminar-4	1	-----	---
TOTAL		22		

SIXTH SEMESTER

Code	Description	Credit hours	Pre-requisite course	Core course
PHT 303	Pharmaceutics VIII (Industrial Pharmacy)	3	PHT 302	☼
PHT 304	Pharmaceutics IX (Hospital Pharmacy)	3	-----	☼
PHL 312	Pharmacology II (Therapeutics)	3	PHL 311	☼
PHC 372	Pharmaceutical Chemistry VII (Quality Assurance of Drugs)	3	PHC 371	☼
PHC 373	Medicinal Chemistry I (Natural Drug)	3	PHG 381	☼
PHG 382	Pharmacognosy V (Himalayan Crude Drugs)	3	PHG 181	☼
LAB-14	Pharmaceutical Laboratory 14	1	-----	---
LAB-15	Pharmaceutical Laboratory 15	1	-----	---
LAB-16	Pharmaceutical Laboratory 16	1	-----	---
SEM-5	Pharmaceutical Seminar-5	1	-----	---
TOTAL		22		

FOURTH YEAR

SEVENTH SEMESTER

Code	Description	Credit hours	Pre-requisite course	Core course
PHT 401	Pharmaceutics X (Cosmetology)	3	PHT 301	☼
PHT 402	Pharmaceutics XI (Clinical Pharmacy)	3	PHT 304	☼
PHL 411	Pharmacology III (Therapeutics and Toxicology)	3	PHL 312	☼
PHC 471	Medicinal Chemistry II (Synthetic Drugs)	3	PHC 373	☼
PHG 481	Pharmacognosy VI (Traditional Systems of Medicine)	3	-----	☼
RES 491	Pharmaceutical Research	3	-----	---
LAB-17	Pharmaceutical Laboratory 17	1	-----	---
LAB-18	Pharmaceutical Laboratory 18	1	-----	---
LAB-19	Pharmaceutical Laboratory 19	1	-----	---
SEM 6	Pharmaceutical Seminar-6	1	-----	---
TOTAL		22		

EIGHTH SEMESTER

Code	Description	Credit hours	Pre-requisite course	Core course
PHT 403	Social Pharmacy and Pharmaceutical Jurisprudence	3	PHT 402	☼
PHT 404	Pharmacoeconomics and Management	3	-----	☼
PHT 405	Pharmacy Practice	3	-----	---
PRW 491	Project Work	6	-----	---
TOTAL		15		

☼ represents the core course.

Notes:

- Two weeks compulsory training in the Hospital and two weeks in Retail Pharmacy as arranged by the Department.
- Two weeks compulsory "In-Plant" training in the Pharmaceutical Industry during the final year as arranged by the Department.
- One week compulsory plant collection and survey of Ethnomedicines as arranged by the Department.
- Three months compulsory Project Work in the Final Year. The Thesis / Report of the Project work should be submitted in the Department with defense.

**B. Pharm.
First Year
First Semester**

PHT 101 (Credit hours 3)

Pharmaceutics I (Fundamentals of Pharmacy)

B. Pharm., First Year, First Semester

Course Objectives:

The students will become familiar with the commonly used terminology in pharmacy practice, which shall provide a broad view of pharmacy education.

Course Contents:

- | | |
|--|-----------------|
| 1. Drugs | 10 hours |
| Drug definition, Doses, Ways of application, Side effects, Bioavailability, Regulation | |
| 2. History of Pharmacy | 3 hours |
| History, Traditional pharmacy, Western pharmacy, Oriental pharmacy | |
| 3. Modern Pharmacy | 5 hours |
| Computer in pharmacy, Patient follow-up, Regulation, Prescription drugs, Over-The-Counter (OTC) drugs, Patient and Society education | |
| 4. Drug Discovery and Development | 8 hours |
| Search for new drugs, New substances versus new method of application, Novel drug delivery system, Patent regulation, Marketing, Food and Drug Administration (FDA), Traditional medicine | |
| 5. Production of Drug | 6 hours |
| Pharmacy-Galenic drugs, Industry, Good manufacturing practices (GMP) and Good laboratory practices (GLP), Regulation, Quality control, Packaging, Advertisement | |
| 6. Role of Pharmacists | 6 hours |
| Retail pharmacy in society, Clinical pharmacy, Industrial pharmacy, Drug regulation, Environment protection, Role in Nepalese society | |
| 7. Pharmacopoeia | 4 hours |
| Pharmacopoeia, Indian Pharmacopoeia, British Pharmacopoeia, United States Pharmacopoeia, European Pharmacopoeia, Japanese Pharmacopoeia, Martindale Pharmacopoeia, Nepalese Formulary, Essential Drug List of Nepal, Essential Drug List of WHO, Merck Index | |
| 8. Research and Literature in Pharmacy | 3 hours |
| Research in pharmacy, Original research articles, Review, Books, Journals, Role of seminar and conference, Role of literature on research | |

Reference Books:

1. A. J. Winfield and R. M. E. Richards: *Pharmaceutical Practice* (2nd Ed.) 1999, Churchill Livingstone, New Delhi.
2. Howard C. Ancel, Nicholas G. Popovich and Loyd V. Allen: *Pharmaceutical Dosage Forms and Drug Delivery System* (6th Ed.) 1995, B. I. Waterly Pvt., Ltd., New Delhi.
3. Michael E. Aulton (Ed.): *Pharmaceutics, The Science of Dosage Form Design*, 1999, Churchill Livingstone, Edinburgh.
4. E. A. Rowlinson (Ed.): *Bentley's The Textbook of Pharmaceutics* (8th Ed.) 2001, Bailliere Tindall, London.

PHC 171 (Credit hours 3)

Pharmaceutical Chemistry I (General Chemistry)

B. Pharm., First Year, First Semester

Course Objectives:

This course is designed to understand general principles of chemistry with principles of qualitative and quantitative analysis. This course will enable the students to understand the general nature of pharmaceutical constituents.

Course Contents:

- 1. Atomic Structure** **8 hours**
Bohr's theory and refinements, Wave mechanical model of the atom, Matter wave, de Broglie's equation, Heisenberg's uncertainty principle, Shapes of s, p, d orbitals, Quantum numbers and their significance, Energy level diagram
- 2. Chemical Bonding** **10 hours**
General characteristics of covalent bond, electrovalent bond, coordinate covalent bond, hydrogen bond, and Van der Waals force and their biological significance, Hybridization, Inductive effect, Electrometric effect, Mesomerism, Resonance, Hyperconjugation, Atomic Orbital, Molecular orbital, Hybrid Orbital, Molecular orbital, Structure of Water, Ammonia, Methane, Ethylene, Acetylene, Benzene
- 3. Periodic Table** **7 hours**
Periodicity of element, s, p, d, f blocks, Long form of periodic table, Discussion of properties (atomic, ionic and covalent radii, ionization potential, screening or shielding effect, electronegativity, electron affinity)
- 4. Nuclear Chemistry** **6 hours**
Composition of nucleus (nuclear stability), Binding energy, Radioactivity, Half-life determination, Nuclear reaction
- 5. Coordination Chemistry** **5 hours**
Werner's theory, Nomenclature, Isomerism, Valence bond theory, Crystal field theory
- 6. Principles of Qualitative and Quantitative Analysis** **9 hours**
Solubility product, Common ion effect, Their application in group separation, Principles of gravimetric and volumetric analysis

Reference Books:

- Samuel H. Maron and Carl F. Prutton: *Principles of Physical Chemistry* (4th Ed.) 1972, Oxford and IBM Publishing Co. Pvt. Ltd., New Delhi.
- B. S. Bahl, G. D. Tuli and Arun Bahl: *Essentials of Physical Chemistry* (24th Ed.) 2000, S. Chand and Company Ltd., New Delhi.
- F. Albert Cotton, Geoffrey Wilkinson and Paul L. Gaus: *Basic Inorganic Chemistry* (3rd Ed.) 2001, John Wiley and Sons Inc., New York.
- Satya Prakash, G. D. Tuli, S. K. Basu, and R. D. Madan: *Advanced Inorganic Chemistry* (18th Ed.) Vol I, 2000, S. Chand and Company Ltd., New Delhi.
- G. Svehla: *Vogel's Qualitative Inorganic Analysis* (7th Ed.) 1998, Longman Group Limited., New York.
- G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney *Vogel's Quantitative Chemical Analysis* (5th Ed.) 1999, Addison Wesley Longman Inc., New York.

PHC 172 (Credit hours 3)

Pharmaceutical Chemistry II (Stereochemistry and Reaction Mechanism)

B. Pharm., First Year, First Semester

Course Objectives:

This course will provide the fundamental knowledge on the structure and chemical reaction of organic molecule or drugs.

Course Contents:

- 1. Structure and Nomenclature Organic Compounds** **7 hours**
Atomic structure, Orbitals, Electron configuration, Covalent bond, Valence bond Theory, Molecular orbital theory, Hybridization of carbon (sp^3 , sp^2 , sp), oxygen, and nitrogen, Drawing of chemical structure, Molecular model, Functional group, Classification of organic compounds, Nomenclature (Classical, IUPAC)
- 2. Stereochemistry** **13 hours**
Stereochemistry and stereoisomerism, Optical activity, Polarimeter, Specific rotation, Enantiomerism and Tetrahedral carbon, Enantiomerism and Optical activity, Prediction of enantiomerism (chirality), Chiral center, Racemic modification, Configuration, Specification of configurations (R and S), Sequence rule, Diastereomers, Epimers, Geometrical isomerism, E and Z -configurations
- 3. Conformational Analysis** **8 hours**
Conformation in open chain system, Conformation in six membered rings, Conformation in six membered rings containing heteroatoms, Conformation in other rings, conformation and physical properties, Conformational effects on stability and reactivity
- 4. Reaction Mechanism** **7 hours**
Types of mechanism, Types of reaction, Thermodynamic and Kinetic requirements for reaction, Kinetic and Thermodynamic control, the Hammond postulate, Microscopic reversibility
- 5. Methods for Determining Mechanism** **5 hours**
Identification of products, Determination of the presence of intermediate, Study of catalysis, Isotope labeling, Stereochemical evidence, Rate expression for the first and second order reaction, Isotope effect
- 6. Reactive Intermediates** **5 hours**
Stability, Structure, Generation, and Fate of Carbocation, Carbanion, Free radical, Carbene, Nitrene, and Benzynes, Nonclassical carbonium ion, Neighbouring group participation by pi- and sigma-bonds, Aromaticity and Anti-aromaticity

Reference Books:

1. John McMurry: *Organic Chemistry* (5th Ed.) 2000, Brooks/Cole Publishing Company (Asian Books Pvt. Ltd.), New Delhi.
2. Robert Thornton Morrison and Robert Neilson Boyd: *Organic Chemistry* (6th Ed.) 1999, Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Jerry March: *Advanced Organic Chemistry* (4th Ed.) 2000, John Wiley and Sons., New York.
4. Ernest L. Eliel: *Stereochemistry of Carbon Compounds*, 1998, Tata-McGraw-Hill Pub. Co. Ltd., New Delhi.

CSC 191 (Credit hours 3)

Computer Science (Introductory)

B. Pharm., First Year, First Semester

Course Objectives:

The objective of the course is to provide the students with a general view of computer architecture, its operation and application, familiarize the students with the existing technologies, and provide them with hands on experience on personal computers.

Course Contents:

- 1. Introduction to Computers** **3 hours**
History of Computers, Classification of Computers, Functioning of Computers, Computer Hardware, Software, Firmware
- 2. Number System** **6 hours**
Decimal number system, Binary number system, Hexadecimal number system, Octal number system, Conversion of a number from one system to other, Addition and Subtraction of binary numbers, Compliments, Subtraction by 2's compliment method
- 3. Boolean Algebra and Logic Gates** **5 hours**
Introduction, Basic operations of Boolean algebra, DeMorgan's Theorem, Boolean variable and function, Boolean postulates, Dual and compliments of Boolean expression, SOP and POS standard forms, Canonical forms of Boolean expression, Simplification of Boolean expressions by Karnaugh method, Logic Gates-AND, OR, NOT, NOR, XOR, XNOR
- 4. Arithmetic Logic Unit and Memory Element** **2 hours**
Half adder, Full adder, Flip-flop, R-S flip-flop
- 5. Memory** **3 hours**
Classification, RAM, ROM, Floppy disk, Hard disk
- 6. Input Output Devices and Computer Network** **5 hours**
Role of input and output devices, Keyboard, Mouse, Scanners, MICR, Video terminals, Printers, Plotters, Digital to analog conversion, Introduction to computer network, Sharing, Network types
- 7. Word Processing** **4 hours**
Introduction, Concept of file, Inputting the text, Formatting, Inserting the files and Symbols, Mail merge facility, Grammar checking, Auto correct feature (MS-Word is to be used)
- 8. Spreadsheet Analysis** **4 hours**
Introduction to spreadsheets, Workbook and worksheet, Formula, Formatting and Graphics (MS-Excel is to be used)
- 9. Database Management** **4 hours**
Data, Database, Input, Processing, Storage, Output (MS-Access is to be used)
- 10. Internet and Multimedia** **4 hours**
Introduction to Internet, e-mail, Introduction to slide, Making a presentation (MS-PowerPoint is to be used)
- 11. Programming Concepts** **5 hours**
Difference between a computer and calculator, Algorithm, Flowchart, Program, Programming language

Reference Books:

1. B. Ram: *Computer Fundamentals*, 1999, Willey Eastern Publication, New Delhi.
2. O. S. Lawrence: *Schaum's Outline of Computers & Business*, 2000, Mc-Grew Hill International., New Delhi.
3. Suresh Basandra: *Computer Systems Today*, 1999, Galgotia Publication, New Delhi.
4. M. Busby and R. A. Stultz: *Office 2000*, 2000, BPB Publication, New Delhi.

MTH 192 (Credit hours 3)

Mathematics (Algebra, Trigonometry and Calculus)

B. Pharm., First Year, First Semester

Course Objectives:

This course deals with the basic principles of mathematics, which will enable the students to apply these tools in pharmaceutical problems

Course Contents:

- 1. Theory of Sets** **5 hours**
Introduction, Types of sets, Venn diagram, Set operation, Number of element in a set, Application
- 2. Function and Graph** **9 hours**
Definition, Injective, surjective and bijective functions, Inverse function, Polynomial, Exponential, Logarithmic, and Trigonometric functions and their graphs, Applications
- 3. Limit and Continuity** **3 hours**
Definition, Limit of a function, Continuity of a function
- 4. Derivatives** **12 hours**
Definition, Techniques of differentiations, Derivatives of algebraic, exponential, logarithmic, and trigonometric functions, Derivatives of higher order, Optimization problems, Partial differentiation, Application
- 5. Integration** **8 hours**
Indefinite integrals, Techniques of integration, Definite integral, Application
- 6. Ordinary Differential Equation and its Application** **8 hours**
Introduction, Classification, Separation of variables, Exact equations, Linear first order equations, Homogenous equation, Application

Reference Books:

1. Ruric E. Wheeler, W. D. Peebles: *Modern Mathematics with Application to Business and Social Sciences*, 2000, Brooks / Cole Publishing Company, New York.
2. Larry J. Gildstein, David C. Lay, David I. Schneider: *Calculus and its Application*, 2001, Prentice Hall International, Inc., New Jersey.
3. Frank S. Budnick: *Applied Mathematics for Business, Economics and the Social Sciences* (4th Ed.) 1993, McGraw-Hill, Inc., New York.
4. Bernard J. Rice and Jerry D. Strange: *Technical Mathematics and Calculus*, 2000, Prindle Weber and Schmidt, New York.
5. George B. Thomas, Jr., Ross L. Finney: *Calculus and Analytic Geometry* (6th Ed.) 1998, Narosa Publishing House, New Delhi.

ENG 193 (Credit hours 3)

Communication Skill (Technical English)

B. Pharm., First Year, First Semester

Course Objectives:

This course is designed to develop the reading, writing and expressing skills in technical English.

Course Contents:

- 1. Review of Written English** **3 hours**
Sentence structure (identification of sentence or its types and transformation of sentences)
- 2. Oral Communication and Note Taking** **15 hours**
Types of English (variety levels of English), Technical talk (Environmental pollution, Construction, Water resources, Impact of computer in modern society, Impact of satellite communication, Urban development)
- 3. Technical Writing Skill** **10 hours**
Preparation of short memoranda (Importance-formats), Business letters (Importance-purposes), Preparation of application (Job application-biodata), Description writing (Process, Mechanism, Place etc.), Seminar papers (Conduction of seminar, Preparation of circular, presenting seminar paper), Preparation of proposals (Importance-type-formats), Preparation of reports (Importance-types-formats).
- 4. Reading Skill** **17 hours**
Comprehension questions and exercises (from prescribed passages- freedom, kinship and the family, Marconi and the invention of Radio, Road foundation, The turbo-prop engine, The use and misuse of science and grief), Outlining or note making from any passages, Precis writing from any passages

Practical Works:

1. To familiarize the students with the audio-visual equipment (Overhead projector, Slide projector, Dictaphone)
2. To watch the visual cassettes and to get familiarized with the language (follow me-I and II)
3. Some general rules of pronunciation
4. Word accent in English
5. Attributes of good English
6. To present a seminar paper
7. To participate in a group discussion
8. To conduct a meeting
9. To prepare and practice to face an interview

Reference Books:

1. Anne Eisenberg: *Effective Technical Communication*, 1982, McGraw-Hill, Inc., New York.
2. A. Houpp and T. E. Pearsall: *Reporting Technical Information*, 1998, Allyn and Bacon, Boston.
3. V. R. Narayanaswami: *Strengthen Your Writing*, 2000, Orient Longman, Madras.
4. Champa Tickoo and Jaya Sasikumar: *Writing with a Purpose*, 1999, Oxford University Press, Bombay.
5. A Handbook of Pronunciation of English Words (with 90 minutes audio cassette) Communication Skill in English.

LAB-1 (Credit hour 1)

Pharmaceutical Laboratory-1

B. Pharm., First Year, First Semester

Course Objectives:

Introduction to laboratory and basic chemical procedures

Course Contents:

1. Laboratory safety, Chemical hazards, Prevention of accidents and Use of reagents and labelling
2. Use of Physical balance, Chemical balance, Micropipettes
3. Pharmacopoeial control and identification tests for important drugs and poisonous substances, environmental hazards, disposal of chemicals
4. Use of pipette, burette and balance (calibration), Standardization of solutions in volumetric analysis.
5. Limit tests for As, Hg, Pb, Fe, Cl and SO₄
6. Estimation of saline solution and calcium
7. Acid/base titration
8. Determination of specific gravity of liquids/syrups/acids etc

Reference Books:

1. John McMurry and Mary E. Castellion: *Fundamentals of General, Organic and Biological Chemistry* (2nd Ed.) 1996, Prentice Hall Inc., New Jersey.
2. Louis F. Fieser: *Organic Experiments*, 1994, CBC Publishers and Distributors, New Delhi.
3. A. H. Beckett and J. B. Stenlake: *Practical Pharmaceutical Chemistry* (4th Ed.) 2000, CBC Publishers and Distributors, New Delhi.

**B. Pharm.
First Year
Second Semester**

PHT 102 (Credit hours 3)

Pharmaceutics II (Physical Pharmacy)

B. Pharm., First Year, Second Semester

Course Objectives:

This course will provide students the physico-chemical phenomena of the substances essential for drug formulation.

Course Contents:

- 1. Physico-Chemical Principles** **10 hours**
A systematic study of the application of physico-chemical principles to pharmaceutical and biomedical sciences, Solubility, Isotonicity, pH, Drug stability and degradation
- 2. Surface Phenomena** **10 hours**
Interfacial properties of surface active agents, Micellization, Micellar structure, Micellar solubilization and its pharmaceutical application
- 3. Disperse System** **12 hours**
 - a) Classification of colloids, Properties of colloidal solutions, Electrical double layer, Stability of lyophobic and hydrophobic colloids, Coacervation and dialysis
 - b) Gels: Properties of gels, Diffusion in gels
- 4. Powder Technology** **8 hours**
Particle shape and size, Particle size analysis, Surface area of powders, Powders flow properties
- 5. Rheology** **5 hours**
Rheology, Newtonian and Nonnewtonian system, Thixotrophy, Determination of rheological properties and its application in pharmacy

Reference Books:

1. A.T. Florence and D. Attwood: *Physico-chemical Principles of Pharmacy* (2nd Ed.) 1994, The MacMillan Press Ltd., London.
2. E. A. Rowlinson (Ed.): *Bentley's The Textbook of Pharmaceutics* (8th Ed.) 2001 Bailliere Tindall, London.
3. Michael E. Aulton (Ed.): *Pharmaceutics, The Science of Dosage Form Design*, 1999, Churchill Livingstone, International Student Edition, Edinburgh.
4. Howard C. Ansel, Nicholas G. Popovich and Loyd V. Allen: *Pharmaceutical Dosage form and Drug Delivery System* (6th Ed.), 1995, B. I. Waterly Pvt., Ltd., New Delhi.

BCM 121 (Credit hours 3)

Biochemistry I

B. Pharm., First Year, Second Semester

Course Objectives:

This course will provide the students about the knowledge on general principles of biochemistry applicable to pharmaceutical sciences.

Course Contents:

1. Physicochemical Phenomena

5 hours

Importance of physicochemical phenomena in Biochemistry, Colloidal state, Surface tension, Viscosity, Osmosis, Diffusion, Buffers, pH, Significance of pH, Henderson-Hasselbalch equation

2. Chemistry and Metabolism of Carbohydrates

15 hours

Introduction, Classification, Monosaccharides, Disaccharides, Polysacchrides, Carbohydrate derivatives, Glycogenesis, Glycogenolysis, Gluconeogenesis, Glycolysis, Tricarboxylic acid cycle, Hexose metabolism via pentose phosphate pathway, Effect of hormones on carbohydrate metabolism

3. Chemistry and Metabolism of Lipids

12 hours

Introduction, Classification, Characterization tests, Fats, Waxes, Soaps, Phospholipids, Glycolipids, Steroids and Sterols, Theories of fat absorption, Oxidation of fatty acids, Synthesis of fatty acids, Abnormalities of lipid metabolism, Eicosanoids, Prostanoids, Leukotrienes, Lipoxygenase and cyclo-oxygenase pathway, Peroxidation of Lipid, Lipoproteins, HDL, LDL, VLDL

4. Chemistry and Metabolism of Proteins

13 hours

Introduction, Classification, Occurrence, General properties, Amino acids, Physicochemical properties, Structure of protein molecule, Metabolism of individual amino acids (e.g. phenyl alanine and tyrosine metabolism), Protein biosynthesis, Nucleic acids, Nucleotides, Nucleosides, RNA synthesis, Initiation, Translation, Elongation, Genetic code and Protein synthesis

Reference Books:

1. Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell: *Harper's Biochemistry* (25th Ed.) 2000, Appleton and Lange, Stamford.
2. Lubert Stryer: *Biochemistry* (4th Ed.) 2000, W. H. Freeman and Company, New York.
3. David L. Nelson and Michel M. Cox: *Lehninger's Principles of Biochemistry* (3rd Ed.) 2000, Macmillan Worth Publisher, New York.

APL 131 (Credit hours 3)

Anatomy and Physiology I

B. Pharm., First Year, Second Semester

Course Objectives:

This course will provide the basic knowledge on the structure and function of human body, which will enable the students to understand scientific basis of the drug action.

Course Contents:

- 1. The Cell (Structure and Function) 10 hours**
An organization of the cell, The membranous structure of the cell, The cytoplasm and its organelles, Functional systems of the cell, Diffusion, Kinetics of diffusion, Diffusion through the cell membrane, Active transport, Pinocytosis and Phagocytosis
- 2. Blood 8 hours**
An introduction of haematology, Functions of blood, Composition of blood, Blood coagulation, Formed elements of blood, Homeostatic imbalances of blood, Blood groups, Interstitial fluid and lymph, Body fluids, Lymphatic system, Reticuloendothelial system
- 3. Digestive System 8 hours**
An introduction of digestive system, Anatomy of gastrointestinal tract, Gastrointestinal movements, Deglutition, Secretions of digestive enzymes, Digestion, Absorption, Defecation, Homeostatic imbalances of the digestive system
- 4. Excretory System 7 hours**
An introduction to excretory system, Anatomy of kidney, Glomerular filtration, Reabsorption and secretion in the tubules, Acid-base balance, Counter current mechanism, Renal disease, Micturition, Abnormalities of micturition
- 5. The Functioning Nerve Cell 4 hours**
Nervous system, Electrical concepts for Neurophysiology action potential, impulse conduction, Synapses neurotransmitter substances
- 6. The Functioning Muscle Cell 4 hours**
Classification of Muscle cell, Muscle structure and function, Homeostatic imbalances of neuromuscular junctions or muscle tissue
- 7. The Autonomic Nervous System 4 hours**
Structure and physiology, Control of autonomic nervous system by the central nervous system

Reference Books:

1. Peter L. Williams et al. (Ed.): *Gray's Anatomy* (38th Ed.) 1995, Churchill Livingstone, Edinburgh.
2. Chummy S. Sinnatamby: *Last's Anatomy Regional and Applied*, 1999, Churchill Livingstone, Edinburgh.
3. Arthur C. Guyton and John E. Hall: *The Textbook of Medical Physiology* (10th Ed.) 2000, Harcourt India Private, New Delhi.

PHC 173 (Credit hours 3)

Pharmaceutical Chemistry III (General Chemistry)

B. Pharm., First Year, Second Semester

Course Objectives:

This course is designed to provide the knowledge on the physical properties of the matter applicable to pharmaceutical preparation.

Course Contents:

- 1. Physical Properties of Molecules** **5 hours**
Surface and interfacial tension, Viscosity, Dielectric constant, Dipole moment, Refractive index and Optical rotation
- 2. Solutions** **6 hours**
Types and properties, Solubility and solubilization, Solutions of electrolytes and non-electrolytes, Dissolution and dissolution rates, Distribution phenomena; Theory of distillation, Molecular weight determination
- 3. Ionic Equilibrium** **6 hours**
Modern theories of acids, bases and salts, pH and acidity constants, Theory of indicators, Buffers and buffered system
- 4. Phase Equilibrium** **5 hours**
Phase rule and its applications to one and two component systems
- 5. Electrochemistry** **7 hours**
Conductivity and its measurement, Conductometric titration, Electrochemical cells, Determination of pH and Redox potentials, Acid/base and Redox titration, Electrophoresis and Electrodialysis
- 6. Thermodynamics and Thermochemistry** **8 hours**
First and second law of thermodynamics, Thermochemistry, Free energy functions and application
- 7. Chemical Kinetics** **8 hours**
Rates and order of reaction, Influence and other factors on reaction rate, Acid-base catalysis, Decomposition of medicinal compounds, Accelerated stability analysis, Kinetics of enzyme-catalyzed reaction

Reference Books:

- 1 Samuel H. Maron and Carl F. Prutton: *Principles of Physical Chemistry* (4th Ed.) 1972, Oxford and IBM Publishing Co. Pvt. Ltd., New Delhi.
- 2 B. S. Bahl, G. D. Tuli and Arun Bahl: *Essentials of Physical Chemistry* (24th Ed.) 2000, S. Chand and Company Ltd., New Delhi.

PHG 181 (Credit hours 3)

Pharmacognosy I (Medicinal Botany)

B. Pharm., First Year, Second Semester

Course Objectives:

This course is designed to understand the basic principles of pharmacognosy, which will enable the students to identify crude drugs and respective medicinal plants.

Course Contents:

- 1. Introduction** **4 hours**
Plants in medicine, The origin of pharmacognosy, The scope and practice of pharmacognosy, Plant nomenclature and taxonomy
- 2. The Plant and Animal Kingdoms as Sources of Drugs** **13 hours**
Biological and geographical sources of drugs, A taxonomic approach to the study of medicinal plants and animal derived drugs, Pharmacological activities of natural products, Synergy in relation to the pharmacological action of phytomedicinals
- 3. Principles Related to the Commercial Production, Quality and Standardization of Natural Products** **12 hours**
Commerce in crude drugs, Production of crude drugs, Plant growth regulators, Plant cells and tissue culture, Phytochemical variation within a species, Deterioration of stored drugs, Quality control
- 4. Some Current Trends** **6 hours**
Plant products and High Throughput Screening, Biologically active compounds from marine organisms, Traditional plant medicines as a source of new drugs
- 5. Medicinal Plants of Nepal** **10 hours**
Simple method of Identification, Nomenclature, Common medicinal uses, and Commercial value of at least 30 medicinal plants found in Nepal

Reference Books:

1. W. C. Evans: Trease and Evans Pharmacognosy, 2002, W. B. Saunders, Harcourt Publisher Limited, London.
2. T. E. Wallis: Text Book of Pharmacognosy, (5th Ed., 1997), CBS Publisher and Distributors, New Delhi.
3. N. P. Manandhar: People and Plants of Nepal, Timber Press, Portland, USA.
4. O. P. Sharma: Plant taxonomy, 1993, Tata-McGraw Hill Publishing Company, New Delhi.
5. A. Eames: An Introduction to Plant Anatomy, 1997, Tata-McGraw Hill Publishing Company, New Delhi.

MTH 194 (Credit hours 3)

Biostatistics

B. Pharm., First Year, Second Semester

Course Objectives:

The student would be able to understand the terminology of statistics and able to read and present pharmaceutical data in the tabular and graphic form, calculate and understand the application of test of significance.

Course Contents:

- 1. Introduction** **4 hours**
Definition, Scope and limitations, Sources of data, Techniques of collecting primary data, General concepts of sampling
- 2. Classification and Presentation of Data** **6 hours**
Data classification (need, objectives, and types of data collection), Construction of frequency and relative frequency distribution and its principles, Tabular presentation, Diagrammatic presentation (Bar and Pie diagram), Graphic presentation (Histogram, Frequency polygon, Ogive), Stem and leaf display presentation
- 3. Fundamental Statistical Measures** **8 hours**
Measures of central tendency (Mean, Median, Mode, Weighted Average and Geometric mean), Measures of dispersion (Range, Quartile deviation, Standard deviation, Coefficient of variation)
- 4. Probability Theory** **6 hours**
Concept and Importance, Types of events, Objective and subjective probabilities, Marginal and joint probabilities, Theorems of probability, Conditional probability, Mathematical expectation
- 5. Probability Distribution** **7 hours**
Discrete probability distribution (Binomial and poisson distribution and mean of their distributions), Continuous probability distributions, Normal distribution, Normal approximation of Binomial distributions
- 6. Test of Significance** **8 hours**
Test of significance (t -test, Z -test, χ^2 -test), Computational procedure of hypothesis testing, Hypothesis testing when population S.D. is known, Hypothesis testing when population S.D. is unknown
- 7. Simple Correlation and Regression Analysis** **6 hours**
Scatter diagram, Correlation, Least square regression, Prediction and Confidence intervals for estimating regression parameters

Reference Books:

1. B. K. Mahajan: *Methods in Biostatistics* (6th Ed.) 1999, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
2. Jit S. Chandan: *Statistics*, 1999, Vikash Publishing House, Pvt. Ltd., New Delhi.

LAB-2 (Credit hour 1)

Pharmaceutical Laboratory-2

B. Pharm., First Year, Second Semester

Course Objectives: *Introduction to basic operations in Pharmaceutics*

Course Contents:

1. Pharmaceutical dilutions and calculations
2. Preparation of isotonic solution
3. Preparation of buffer and its stability
4. Coacervation
5. Preparation of colloidal systems
6. Particle size analysis

Reference Books:

1. Sheila J. Ogden: *Calculation of Drug Dosages* (7th Ed.) 2003, Mosby, St. Luis.

LAB-3 (Credit hour 1)

Pharmaceutical Laboratory-3

B. Pharm., First Year, Second Semester

Course Objectives: *Introduction to Pharmaceutical Chemistry*

Course Contents:

1. One step preparation of compounds of medicinal properties
2. Assay of pharmaceutical compounds based on acid-base, oxidation-reduction, precipitation and diazotization titration
3. Preparation of complexes and complexometric titration
4. Gravimetric determination of official compounds and detection of metal ions

Reference Books:

1. John McMurry and Mary E. Castellion: *Fundamentals of General, Organic and Biological Chemistry* (2nd Ed.) 1996, Prentice Hall Inc., New Jersey.
2. A. H. Beckett and J. B. Stenlake: *Practical Pharmaceutical Chemistry* (4th Ed.) 2000, CBC Publishers and Distributors, New Delhi.

LAB-4 (Credit hour 1)

Pharmaceutical Laboratory-4

B. Pharm., First Year, Second Semester

Course Objectives: *Introduction to Pharmacognosy*

Course Contents:

1. Preparation of Herbarium (at least 20 samples)
2. Collection of crude drugs (at least 20 samples)
3. Crude identification by physical appearance and microscopic studies (at least 20 samples)
4. Preparation of report on a particular natural medicine
5. Quality control: Extractive value, ash value, moisture contents
6. Extraction of Ten crude drugs
7. TLC pattern of Ten crude drugs

Reference Books:

SEM-1(Credit hour 1)

Pharmaceutical Seminar-1

**B. Pharm.
Second Year
Third Semester**

PHT 201 (Credit hours 3)

Pharmaceutics III (Dosage Forms and Formulations A)

B. Pharm., Second Year, Third Semester

Course Objectives:

The students will become familiar with the commonly administered dosage forms, their characteristics and preparations methods, which shall provide a broad view of pharmaceuticals.

Course Contents:

- 1. Dosage Forms Design** **4 hours**
General considerations, Pharmaceutical ingredients, Current Good Manufacturing Practice, Packaging
- 2. Solid Dosage Forms for Oral Administration** **12 hours**
Powders, Granules, Granulation, Tablets, Capsules, Rate-controlled dosage forms, Drug delivery systems, Packaging
- 3. Solutions, Syrups and Elixirs for Oral Administration** **6 hours**
Solubility, Solutions, Syrups, Elixirs, Packaging
- 4. Dispersed Systems for Oral Administration** **8 hours**
Oral suspensions, Rheology, Emulsions, Colloidal dispersions, Magmas and gels, Packaging
- 5. Parenteral Medications and Sterile Fluids** **12 hours**
Parenteral routes of administration, Injections, Methods of sterilization, Pyrogens and pyrogen testing, Industrial manufacturing, Packaging, Quality assurance system, Large volume parenterals, Biologicals, Pellets or implants, Irrigation solutions, Dialysis solutions
- 6. Miscellaneous Preparations** **3 hours**
Crude drugs, Tinctures, Fluid extracts, Extracts, Aromatic waters, Spirits, Effervescent salts, Divided powders, Packaging

Reference Books:

- Howard C. Ansel, Loyd V. Allen and Nicholas G. Popovich: *Pharmaceutical Dosage Forms and Drug Delivery System* (7th Ed.) 1999, Lippincott Williams and Wilkins, Philadelphia.
- Michael E. Aulton (Ed.): *Pharmaceutics, The Science of Dosage Form Design*, 1999, Churchill Livingstone, International Student Edition, New Delhi.
- E. A. Rowlinson (Ed.): *Bentley's Textbook of Pharmaceutics* (8th Ed.) 2001, Bailliere Tindall, London.
- R. Gennaro (Ed.): *Remington's Pharmaceutical Sciences* (18th Ed.) 1990, Mack Publishing Company, Easton.

BCM 221 (Credit hours 3)

Biochemistry II

B. Pharm., Second Year, Third Semester

Course Objectives:

This course will provide a basic knowledge on vitamins, hormones and enzymes and their application in pharmaceutical sciences.

Course Contents:

1. Vitamins

18 hours

Chemistry, Physiological functions, Deficiency symptoms, Sources, Requirements and therapeutic uses of the following vitamins: vitamin A, vitamin D, vitamin K, vitamin E and D, and vitamins of B group, (i.e. thiamine, riboflavin, niacin, pantothenic acid, pyridoxine, lipoic acid, biotin, inositol, paraaminobenzoic acid, folic acid, vitamin B₁₂).

2. Hormones

17 hours

Chemistry, Mechanism of action, Biosynthesis, Release, Metabolic function and therapeutic uses of the following hormones: insulin, glucagon, thyroxine, parathormone, adrenaline, noradrenaline, corticosteroids, sex hormones, hormones of hypophysis, hypothalamic regulating factors and hormone antagonists.

3. Enzymes

10 hours

General properties, Classification, Factors influencing enzyme action, Kinetics, Michalis-Menten equation, Lineweaver-Burk plot, Inhibitors and activators, Competitive and noncompetitive inhibitor, Regulation of enzyme activity.

Reference Books:

1. Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell: *Harper's Biochemistry* (25th Ed.) 2000 Appleton and Lange, Stamford.
2. Lubert Styrer: *Biochemistry* (4th Ed.) 2000, W. H. Freeman and Company, New York.
3. David L. Nelson and Michel M. Cox: *Lehninger's Principles of Biochemistry* (3rd Ed.) 2000, Macmillan Worth Publisher, New York.

APL 231 (Credit hours 3)

Anatomy and Physiology II

B. Pharm., Second Year, Third Semester

Course Objectives:

This course will provide the basic knowledge on the structure and function of human body, which will enable the students to understand scientific basis of drug action.

Course Contents:

- 1. Respiratory System** **10 hours**
A general introduction and physiological anatomy of respiratory system, Pulmonary ventilation, Mechanism of respiration, Volume and capacities, Gaseous exchange, Transport of gases, Regulation of respiration
- 2. Nervous System** **12 hours**
Protection and coverings, Cerebrospinal fluid, Blood supply, Brain stem, Diencephalon, Cerebrum, Brain waves, Cerebellum, Cranial nerves, Homeostatic imbalances of the central nervous system
- 3. Circulatory System** **10 hours**
Introduction, Anatomy of heart, Conduction system of heart, Nervous regulation of heart, Coronary circulation, Cardiac cycle, Blood pressure, Heart rate cardiac output and homeostatic imbalances of the cardiovascular
- 4. Endocrinology and Reproduction** **13 hours**
An introduction to endocrinology. Male and female reproductive organs. Male and female sex hormones. Mechanism of hormonal action, Endocrine regulation, The pituitary hormones and their control by the hypothalamus. The thyroid metabolic hormones, The adrenal hormones. Homeostatic imbalances of the above mentioned hormones. Reproductive functions of the male and female sex hormones, Menstrual cycle

Reference Books:

1. Peter L. Williams et al. (Ed.): *Gray's Anatomy*, (38th Ed.) 1995, Churchill Livingstone, New York.
2. Chummy S. Sinnatamby: *Last's Anatomy Regional and Applied*, 1999, Churchill Livingstone, New York.
3. Arthur C. Guyton and John E. Hall: *Guyton Human Physiology and Mechanisms of Disease*, 1996, Harcourt Publishers Limited, Singapore.

CBL 241 (Credit hours 3)

Molecular Cell Biology (Genetic Engineering)

B. Pharm., Second Year, Third Semester

Course Objectives:

This course is designed to explain the general principles of genetic engineering and its application to pharmaceuticals.

Course Contents:

- 1. Fundamental Terminology** **3 hours**
DNA, RNA, Nucleotides, Nucleosides, tRNA, mRNA, Translation, Transcription, Genes
- 2. RNA and Protein Synthesis** **8 hours**
Process of DNA transcription, The promoter sequence, Translation of nucleotide sequence into protein sequence, Specific enzyme copulation, Addition of amino acids to the carboxyl terminal end, Degeneration of genetic code, Protein synthesis in ribosome, Release of a protein chain from ribosome, The reading frame for protein synthesis, Protein synthesis in eucaryotes and procaryotes
- 3. DNA Repair Mechanism** **4 hours**
DNA sequence maintenance, Mutation rate and its importance, Stability of genes and DNA repair, Recognition of DNA damage
- 4. DNA Replication Mechanism** **6 hours**
DNA replication, Proof reading mechanism, DNA replication in the 5' to 3', DNA primers, DNA helicases, DNA primase, Mismatch proof reading, Replication origins, DNA topoisomerase, DNA replication in eucaryotes and procaryotes
- 5. Genetic Recombination Mechanism** **6 hours**
Genetic recombination, General recombination, DNA renaturation (hybridization), recA protein, Branch migration, Cross-Strand exchange, Gene conversion, Site-specific genetic recombination
- 6. Virus, Plasmids and Transposable Genetic Elements** **6 hours**
Viral genomes, RNA virus, DNA virus, Provirus, Retrovirus, Reverse transcriptase, Plasmids
- 7. DNA Cloning and Genetic Engineering** **10 hours**
Restriction Nucleases, DNA library, Plasmid vectors, Genomic DNA cline, cDNA, Subtractive hybridization, Chromosome walking, Hybrid selection, Expression vectors, Design of genes, Insertion of engineered genes, Transgenic animal, PCR, Mapping and analysis of large genomes
- 8. Use of Genetic Engineering in Pharmaceutical Sciences** **2 hours**
Production of commercial insulin from *E. Coli*

Reference Books:

1. Bruce Albert, Dennis, Bray, Julians Lewis, Martin Raff, Keith Roberts and James D. Watson: *Molecular Biology of the Cell* (2nd Ed.) 1989, Garland Publishing, Inc, New York.
2. James Darnell, Harvey Lodish and David Baltimore: *Molecular Cell Biology* (2nd Ed.) 1990, Scientific American Books, New York.

PHC 271 (Credit hours 3)

Pharmaceutical Chemistry IV (Analytical Chemistry)

B. Pharm., Second Year, Third Semester

Course Objectives:

This course is designed to explain the general principles of instrumental analysis techniques and their application in pharmaceutical products.

Course Contents:

- 1. An Introduction to Analytical Methods** **5 hours**
Classification of analytical methods, Types of instrumental methods, Instruments for analysis, Selection of analytical methods, Calibration of instrumental methods
- 2. An Introduction to Spectrometric Methods** **5 hours**
Wave properties of electromagnetic radiation, Quantum-mechanical properties of radiation, Component of optical instrument
- 3. Atomic Absorption and Fluorescence Spectrometry** **5 hours**
Sample atomization technique, Atomic absorption instrumentation, Atomic absorption analytical technique, Atomic fluorescence spectroscopy
- 4. Atomic Emission Spectrometry** **5 hours**
Emission spectroscopy based on plasma source, Emission spectroscopy based on arc and spark sources, Miscellaneous sources for optical emission spectroscopy
- 5. Flame Photometry** **5 hours**
Principles of flame photometry, Inferences in flame photometry, Evaluation method in flame photometry,
- 6. Polarimetry** **5 hours**
Polarised light, Application of polarimetry, Optical rotatory dispersion (ORD) and circular dichroism (CD), Principles and instrumentation for ORD and CD
- 7. Potentiometry** **5 hours**
Electrochemical cells, Electrode potential, Standard electrode potential, Various electrodes in potentiometry, Instrumentation, Potentiometric titration, Potentiometry in quantitative analysis
- 8. Polarography and Voltametry** **5 hours**
Principles, Instrumentation, Application of polarography and voltametry
- 9. Conductometry** **5 hours**
Principles, Instrumentation, Application of conductometry

Reference Books:

1. Douglas A. Skoog, F. James Holler and Timothy A. Nieman: *Principles of Instrumental Analysis* (5th Ed.) 1998, Harcourt College Publisher (Harcourt Asia PTE Limited), Singapore.
2. S. M. Khopkar: *Basic Concept of Analytical Chemistry*, 1998, New Age International (P) Ltd. Publisher, New Delhi.

PHG 281 (Credit hours 3)

Pharmacognosy II (Spectroscopy)

B. Pharm., Second Year, Third Semester

Course Objectives:

This course is designed to provide the knowledge on the basic theory and application of spectroscopic methods to elucidate the structure of organic molecules.

Course Contents:

- 1. Energy and Electromagnetic Spectrum** **2 hours**
Units, The electromagnetic spectrum, Absorption of electromagnetic radiation by organic molecule
- 2. Ultraviolet-Visible Spectroscopy** **6 hours**
Colour and light absorption, The chromophore concept, Theory of electronic spectroscopy, Instrumentation and sampling, Solvent effect, Applications
- 3. Infrared Spectroscopy** **5 hours**
Unit of frequency, Wave length and wave number, Molecular vibration, Factors influencing vibrational frequencies, Instrumentation, Applications
- 4. Nuclear Magnetic Resonance Spectroscopy** **18 hours**
Proton NMR Spectroscopy: The NMR phenomenon, Theory of NMR, Instrumentation, Chemical shift and its measurement, Factors influencing chemical shift, Correlation data, Use of solvent, Integration, Spin-spin coupling, Factors influencing the coupling constant, Non-first-order spectra
Carbon-13 NMR Spectroscopy: Natural abundance ^{13}C -NMR spectra, Structural application, Correlation data
Advanced techniques in NMR: Spin-spin coupling and double irradiation, Internuclear double resonance, Selective population inversion, Nuclear Overhauser Effect, Variable-temperature NMR, Multipulse technique, DEPT, ^1H - ^1H -COSY, ^1H - ^{13}C -COSY (HMQC), ^1H - ^1H -Long-range COSY(HMBC)
- 5. Mass Spectroscopy** **8 hours**
Basic principles, Instrumentation, Isotope abundances, Metastable ions, Fragmentation process, Fragmentation associated with functional groups, EI, CI, FD, FAB and GC-MS
- 6. X-ray analysis** **6 hours**
Basic principles, Instrumentation and application of X-ray methods in structure determination of organic molecules

Reference Books:

1. William Kemp: *Organic Spectroscopy* (3rd Ed.) 1991, Macmillan Press Ltd., London.
2. R. M. Silverstein, G. C. Baller and T. C. Morrill: *Spectrometric Identification of Organic Compounds*. (5th Ed.) 1991, John Wiley and Sons, Inc. London.
3. John R. Dyer: *Applications of Absorption Spectroscopy of Organic Compounds*, 1965, Prentice-Hall, Inc., London.

LAB-5 (Credit hour 1)

Pharmaceutical Laboratory-5 (Pharmaceutics)

B. Pharm., Second Year, Third Semester

Course Objectives: *The students will become familiar with the basic principles of manufacturing of drug dosage forms and formulations (A)*

Course Contents:

1. Particle size analysis (applied to powders)
2. Granulation
3. Tablets
4. Syrups and Elixiers
5. Injections and Sterilization
6. Crude drugs extracts
7. Tinctures
8. Divided powders

Reference Books:

Japanese Pharmacopoeia XIII

LAB-6 (Credit hour 1)

Pharmaceutical Laboratory-6 (Spectral Analysis)

B. Pharm., Second Year, Third Semester

Course Objectives: *The students will become familiar with the basic principles of spectroscopy and able to identify small organic molecules with the help of UV, IR, NMR and mass spectra.*

Course Contents:

1. Use of UV spectra
2. Use of IR spectra
3. Use of NMR spectra
4. Use of Mass spectra
5. Use of X-ray data

Reference Books:

1. R. M. Silverstein, G. C. Baller and T. C. Morrill: *Spectrometric Identification of Organic Compounds* (5th Ed.) 1991, John Wiley and Sons Inc., London.
2. William Kemp: *Organic Spectroscopy* (3rd Ed.) 1991, Macmillian Press Ltd., London

LAB-7 (Credit hour 1)

Pharmaceutical Laboratory-7 (Quality Evaluation of Natural Drugs)

B. Pharm., Second Year, Third Semester

Course Objectives: *Student will learn general principle of extraction and isolation of some important crude drugs.*

Course Contents:

1. Quality control: Extractive value, ash value, moisture contents
2. Extraction of ten crude drugs
3. Extraction of essential oils
4. TLC pattern of ten crude drugs
5. Use of column chromatography

Reference Books:

1. Japanese Pharmacopoeia XIII
2. Indian Pharmacopoeia (1996)

SEM-2 (Credit hour 1)

Pharmaceutical Seminar-2

B. Pharm., Second Year, Third Semester

**B. Pharm.
Second Year
Fourth Semester**

PHT 202 (Credit hours 3)

Pharmaceutics IV (Dosages Forms and Formulation B)

B. Pharm., Second Year, Fourth Semester

Course Objectives:

The students will become familiar with the commonly administered dosage forms, their characteristics and preparations methods, which shall provide a broad view of pharmaceuticals.

- 1. Dermatological Dosage Forms** **15 hours**
Percutaneous absorption, Skin, Transdermal drug delivery systems, Ointments, Preservation, Creams, Pastes, Lotions, Topical solutions, Tinctures, Liniments, Collodions, Glycerogelations, Plasters, Powders for application to the skin, Topical aerosols, Tapes, Packaging
- 2. Dosage Forms Applied Topically to Eye, Ear, Nose and Oral Cavity** **8 hours**
Ophthalmic preparations, Sterilization and preservation, Isotonicity, Ophthalmic solutions, Ophthalmic suspensions, Ophthalmic ointments, Ophthalmic inserts, Contact lenses, Nasal preparations, Optic preparations, Packaging
- 3. Rectal, Vaginal and Urethral Dosage Forms** **6 hours**
Suppositories, Vaginal dosage forms, Urethral preparations, Packaging
- 4. Pharmaceutical Aerosols** **6 hours**
Aerosols, Containers, Inhalations, Sprays
- 5. Radiopharmaceuticals** **3 hours**
The practice of nuclear pharmacy, Positron emission tomography, Radiopharmaceuticals
- 6. Biotechnology and Drugs** **4 hours**
Recombinant DNA, Products of biotechnology, The future, Role of pharmacist
- 7. Novel Drug Delivery Systems** **3 hours**
Drugs and vaccines presently available on the market, The future

Reference Books:

1. Howard C. Ansel, Loyd V. Allen and Nicholas G. Popovich: *Pharmaceutical Dosage form and Drug Delivery System* (7th Ed.) 1999, Lippincott Williams and Wilkins, Philadelphia.
2. Michael E. Aulton (Ed.): *Pharmaceutics, The Science of Dosage Form Design*, 1999, Churchill Livingstone, International Student Edition, New Delhi.
3. E. A. Rowlinson (Ed.): *Bentley's The Textbook of Pharmaceutics* (8th Ed.) 2001, Bailliere Tindall, London.
4. A. R. Gennaro (Ed.): *Remington's Pharmaceutical Sciences* (18th Ed.) 1990, Mack Publishing Company, Easton.

PHT 203 (Credit hours 3)

Pharmaceutics V (Biopharmaceutics A)

B. Pharm., Second Year, Fourth Semester

Course Objectives:

This course will provide the students the knowledge on general principles of bioavailability and biopharmaceutics applicable to pharmaceutical sciences.

Course Contents:

- 1. The Concept of Biopharmaceutics** **10 hours**
General principles of drug absorption, Dissolution and drug absorption, Biological membranes and drug transport, Routes of administration and absorption processes
- 2. Pharmacokinetic Principles** **8 hours**
Reaction rate and Reaction order, Half-life, Concept of clearance, Dosage regimen considerations, Blood concentration-time curve
- 3. Fate of Drugs after Administration** **8 hours**
ADME process, Pharmacokinetic models, Non-linear pharmacokinetics, Excretion of drugs
- 4. Bioavailability and Bioequivalence** **13 hours**
The concept of bioavailability, Factors affecting bioavailability, Drug absorption from GI tract, Assessment of bioavailability, *In vitro* and *in vivo* bioavailability testing, Regulatory bioavailability requirements
- 5. Drug Interactions and Incompatibilities** **6 hours**
pH effect *in vitro* and *in vivo*, Cation-anion interaction, Chelation and complexation, Adsorption of drugs, Drugs interactions with plastics, Protein binding, Drugs interaction based on physical mechanism

Reference Books:

1. Howard C. Ansel, Loyd V. Allen, Jr., and Nicholas G. Popovich: *Pharmaceutical Dosage form and Drug Delivery System* (7th Ed.) 1999, Lippincott Williams and Wilkins, Philadelphia.
2. A. T. Florence and D. Attwood: *Physicochemical Principles of Pharmacy* (2nd Ed) 1994, The Macmillan Press Ltd., London.
3. Michael E. Aulton (Ed.): *Pharmaceutics, The Science of Dosage Form Design*, 1999, Churchill Livingstone, International Student Edition, New Delhi.
4. P. I. D. Lee and G. L. Amidon: *Pharmacokinetic Analysis: A Practical Approach*, 1996, Technomic Publ. Co, Lancaster.

MBL 251 (Credit hours 3)

Pharmaceutical Microbiology I (General)

B. Pharm., Second Year, Fourth Semester

Course Objectives:

This course will provide the basic knowledge on microbiology and its general application to pharmaceutical preparation.

Course Contents:

- 1. Fundamentals of Microbiology** **10 hours**
Virus, Rickettsiae, Chlamydiae, Mycoplasma, Bacteria, Actinomycetes, Fungi,
- 2. The Action of Physical and Chemical Agents on Micro-organisms** **10 hours**
The kinetics of cell inactivation, Antimicrobial effect of moist and dry heat, Ionizing Radiation, Ultraviolet radiation, Gases, Antimicrobial effects of Chemical agents, Antibiotics and chemotherapeutic agents
- 3. Principles of Sterilization** **4 hours**
The importance of sterility, Definition, Determination of sterilization protocols, Integrated lethality in sterilization practice, Test for sterility of the products
- 4. Microbial Contamination and Preservation of Pharmaceutical Preparation** **6 hours**
Source and incidence of contamination, Growth of microorganisms in pharmaceutical products, Consequences of contamination, Screening for contamination, Control of microbial contamination, The preservation of pharmaceutical preparation, Microbial standard for pharmaceutical preparation
- 5. Pharmaceutical Application of Microbiological Techniques** **8 hours**
Measurement of antimicrobial activity, Antibiotic assay, Amino acid and vitamin assay, The measurement of minimum inhibitory concentration (MIC), Counting of micro-organism in pharmaceutical products, Pyrogen testing, Challenge tests (preservative efficacy test), Disinfectant evaluation
- 6. Biologicals** **7 hours**
Production of vaccines and antisera, Biological testing and pathogenicity, Toxicity, Pyrogen tests

Reference Books:

1. M. E. Aulton (Ed.): *Pharmaceutics, The Science of Dosage Form Design*, 1999, Churchill Livingstone, International Student Edition, New Delhi.
2. E. A. Rowlinson (Ed.): *Bentley's The Textbook of Pharmaceutics* (8th Ed.) 2001, Bailliere Tindall, London.
3. W. B. Hugo and A. D. Russell: *Pharmaceutical Microbiology* (6th Ed.) 1998, Blackwell Scientific Publication, Oxford.
4. M. J. Pelczar, E. C. S. Chan and N. R. Krieg: *Microbiology* (5th Ed.) 1986, Tata Mc Graw-Hill Book Company, New Delhi.

IML 261 (Credit hours 3)

Immunology (Fundamentals of Immunology)

B. Pharm., Second Year, Fourth Semester

Course Objectives:

This course will provide the fundamental knowledge on the immune system.

Course Contents:

- 1. Introduction to the Immune System** **6 hours**
Adaptive and innate immunity, Cells of the immune system, Soluble mediators of immunity, Antigens, Immune responses, Defences against extracellular and intracellular pathogens, Vaccination, Immunopathology
- 2. Cells Involved in Immune Responses** **4 hours**
Lymphoid cells, Mononuclear phagocyte system, Polymorphonuclear granulocytes and platelets
- 3. The Lymphoid System** **4 hours**
Primary and secondary lymphoid tissue, Primary lymphoid organs, Secondary lymphoid organs and tissues, Lymphocyte traffic
- 4. Antigen Receptor Molecules** **4 hours**
Immunoglobulins, T-cell antigen receptors, Major histocompatibility complex antigens
- 5. Antigen Recognition** **6 hours**
Antigen-Antibody binding, The structure of antigens, T-cell-antigen recognition, Antigen processing and presentation, Role of accessory molecules, basic immunological application (Immunofluorescence, RIA, ELISA)
- 6. Cell Cooperation in the Antibody Response** **4 hours**
Cooperation between different cell types, Cell activation, Antibody responses *in vivo*
- 7. Cell-Mediated Immune Reactions** **6 hours**
T-cell-independent cell-mediated defense mechanism, T-cell-dependent cell-mediated responses, Cell-mediated cytotoxicity, Lymphokine-mediated activation of macrophages, Granuloma formation, Immunopathology, The cytokine network
- 8. Regulation of the Immune Response** **4 hours**
Regulation by antigen, Regulation by antibody, Regulation by immune complexes, Regulation by lymphocyte
- 9. Immunological Tolerance** **4 hours**
T-cell tolerance to self antigens, B-cell tolerance to self antigens, Artificially induced tolerance *in vivo*, Artificially induced tolerance *in vitro*, Potential therapeutic applications of tolerance
- 10. Complement** **4 hours**
Introduction, Activation of complement, Complement receptors, Biological effects of complement

Reference Books:

- Ivan Roitt, Jonathan Brostoff and David Male (Ed.): *Immunology* (3rd Ed.) 1993, Mosby-Year Book Europe Limited, London.
- Ivan Roitt: *Essential Immunology* (8th Ed.) 1994, Blackwell Scientific Publication, London.

PHC 272 (Credit hours 3)

Pharmaceutical Chemistry (Basic Organic Reaction)

B. Pharm., Second Year, Fourth Semester

Course Objectives:

This course is designed to understand the basic principles of reaction mechanism of some common organic reactions.

Course Contents:

- 1. Nucleophilic Aliphatic Substitution** **10 hours**
Definition of nucleophilic aliphatic substitution reaction, Nucleophile and leaving groups, Mechanism and kinetics of S_N2 reaction, Role of substrate, Stereochemistry, Steric hindrance and solvent in S_N2 reaction, Mechanism and kinetics of S_N1 reaction, Role of substrate, Stereochemistry, Steric hindrance and solvent in S_N1 reaction, Comparative study of S_N1 and S_N2 reactions, Some biologically important substitution reactions.
- 2. Electrophilic Aromatic Substitution** **8 hours**
Introduction, Effect of substituent groups, Determination of orientation, Determination of relative reactivity, Classification of substituent group, Orientation of disubstituted benzene, Mechanism of nitration and sulfonation,
- 3. Nucleophilic Acyl Substitution Reaction** **8 hours**
Introduction to carboxylic acid derivatives and nitriles, Nucleophilic acyl substitution reactions, Nucleophilic acyl substitution reactions of carboxylic acid, Chemistry of acid halides, acid anhydrides, esters, amides, nitriles, thiol ester, Biological carboxylic acid derivatives
- 4. Elimination Reaction** **8 hours**
Definition and types of elimination reaction, Zaitsev's rule, Kinetics and mechanism E2 reaction, Elimination reaction and cyclohexane conformation, Kinetics and mechanism E1 reaction, Comparative study of E2 and E1, Elimination vs. substitution, Dehydration of alcohol
- 5. Addition Reaction** **5 hours**
Addition of halogen to alkene, Halohydrin formation, Addition of water to alkenes (oxumercuration, hydroboration), Addition of carbene to alkene, Hydrogenation,
- 6. Nucleophilic Addition Reaction** **6 hours**
Aldehydes and ketones, Nucleophilic addition reaction of aldehydes and ketones, Relative reactivity of aldehyde and ketone, Nucleophilic addition of water, HCN, Grignard reagent, amines, hydrazine, alcohols, phosphorus ylide,

Reference Books:

1. John McMurry, *Organic Chemistry* (5th Ed.) 2000, Brooks/Cole Publishing Company (Asian Books Pvt. Ltd.), Pacific Grove.
2. Robert Thornton Morrison and Robert Neilson Boyd, *Organic Chemistry* (6th Ed.) 1999, Prentice-Hall of India Pvt. Ltd., New Delhi.
3. Jerry March, *Advanced Organic Chemistry* (4th Ed.) 2000, John Wiley and Sons, New York.
4. Ernest L. Eliel, *Stereochemistry of Carbon Compounds*, 1998, Tata-McGraw-Hill Pub. Co. Ltd, New Delhi.

PHG 282 (Credit hours 3)

Pharmacognosy III (Natural Products Chemistry)

B. Pharm., Second Year, Fourth Semester

Course Objectives:

This course is designed to understand general principles of chromatographic methods used for the separation and isolation of organic compounds obtained from natural and synthetic sources.

Course Contents:

- 1. Drugs and Natural products** **3 hours**
An outline on discovery of some important drugs from natural products, History of natural products chemistry, Bioactivity screening of organic natural products
- 2. Extraction, Isolation and Purification** **8 hours**
General techniques of extraction, separation, and purification. Column chromatography, Thin-layer chromatography (TLC), Paper chromatography, Ion-exchange chromatography, Gas chromatography, Gel Chromatography, Droplet counter current chromatography, High performance liquid chromatography (HPLC), Electrophoresis, High performance capillary electrophoresis (HPCE)
- 3. Structure Determination** **5 hours**
Use of spectroscopic technique to elucidate the structure of natural products
- 4. Biosynthesis** **4 hours**
An outline of biosynthesis of natural products: Sugar, Isoprenoids, Polyketides, Phenylpropanoids, Amino acids, Polypeptides, Alkaloids, Concept of chemotaxonomy
- 5. Fatty acids and Related Compounds** **5 hours**
Arachidonic acid cascades, Prostaglandins, Thromboxan and prostacyclin, Leukotriene and hydroperoxy-eicosatetraenoic acid, eicosapentanoic acid
- 6. Terpenoids** **7 hours**
Introduction, Classification, General method of determining structure, Monoterpene, Sesquiterpene, Diterpene, Sesterpene, Triterpene
- 7. Carotenoids** **5 hours**
Introduction, Carotenes, β -Carotenes, α -Carotenes, Lycopene, γ -Carotenes, Vitamin A, Xanthophylls, Biosynthesis of carotenoids
- 8. Steroids** **8 hours**
Introduction, Sterols, Cholesterol, Spectral properties of steroids, Stereochemistry of steroids, Ergosterol, Vitamin D, Stigmasterol, Biosynthesis of sterol, Bile acids, Steroid hormones, Homosteroids and Norsteroids, Adrenocortical hormones, Steroidal glycosides and alkaloids

Reference Books:

- Mitsubashi et al (Ed) *Integrated Essential Natural Product Chemistry* (3rd Ed.) 1999, Minami Publishing House, Tokyo (Japanese).
- I. L. Finar: *Organic Chemistry Volume 2: Stereochemistry and Chemistry of Natural Products* (5th Ed.) 2000, Longman Scientific and Technical (Pearson Education Asia), New Delhi.
- Gurdeep R. Chatwal: *The Chemistry of Organic Natural Products* Vol I and II, 1983, Himalaya Publishing House, Bombay.
- Paul M. Dewick: *Medicinal Natural Products, A Biosynthetic Approach* (2nd Ed.) 2002, J. Wiley and Sons, Chichester.

LAB-8 (Credit hour 1)

Pharmaceutical Laboratory-8

B. Pharm., Second Year, Fourth Semester

Course Objectives: *The students will become familiar with the basic principles of manufacturing of drug dosage forms and formulations (B)*

Course Contents:

1. Ointments and creams
2. Pastes and lotions
3. Accelerated stability testing
4. Ophthalmic preparations
5. Nasal preparations
6. Otic preparations
7. Suppositories and vagitories

Reference Books:

LAB-9 (Credit hour 1)

Pharmaceutical Laboratory-9

B. Pharm., Second Year, Fourth Semester

Course Objectives: *Student will learn simple preparation and Pharmacopoeal standards of some pharmaceutical products.*

Course Contents:

1. Preparation of some pharmaceutical compounds as mentioned in Japanese Pharmacopoeia and Indian Pharmacopoeia (at least five samples)
2. Assay of Pharmaceutical compounds as mentioned in relevant Pharmacopoeia (at least 5 sample)

Reference Books:

1. Japanese Pharmacopoeia XIII
2. Indian Pharmacopoeia (1996)

LAB-10 (Credit hour 1)

Pharmaceutical Laboratory-10

B. Pharm., Second Year, Fourth Semester

Course Objectives: *Student will take part in field trip and prepare 20 herbaria and collect 10 crude drugs from the field.*

Course Contents:

1. Preparation of herbarium (at least 20 sample each) and crude drug (at least 10 sample each) in the field and identify and preserve in the laboratory. Prepare one report on collection and identification.

Reference Books:

SEM-3 (Credit hour 1)

Pharmaceutical Seminar-3

B. Pharm., Second Year, Third Semester

**B. Pharm.
Third Year
Fifth Semester**

PHT 301 (Credit hours 3)

Pharmaceutics VI (Biopharmaceutics B)

B. Pharm., Third Year, Fifth Semester

Course Objectives:

This course will provide the students with the further knowledge on bioavailability and bioequivalence of pharmaceutical products, with special emphasis on pharmacokinetics and pharmacodynamics and factors affecting the both.

Course Contents:

- 1. Influence of Formulation on Pharmacokinetics - Bioequivalence** **4 hours**
Pharmacokinetic models, Requirements
- 2. Influence of Dosage on Pharmacokinetics - Dose Proportionality** **4 hours**
Pharmacokinetic models, Concentration profiles of drugs and metabolites
- 3. Pharmacokinetics of Sustained Release and Immediate Release Formulations** **5 hours**
Formulations with first-order release rate, Zero-order release, Immediate-release plus zero-order release
- 4. Absorption of Drugs in the Gastrointestinal Tract** **4 hours**
Influence of gastric emptying, Constant intrainestinal infusions, Effect of various GI sites
- 5. Drug Distribution into Tissue – Tissue Penetration** **4 hours**
Irreversible distribution, Reversible distribution, Penetration into sputum, Penetration into saliva, Penetration into blister fluid
- 6. Pharmacokinetics of Metabolites** **6 hours**
Parallel metabolic pathways, Metabolic pathways in series, Reversible metabolism with elimination from the parent drug, Reversible metabolism with elimination from the metabolite, Reversible metabolism with elimination from both parent drug and metabolite, Combination of irreversible and reversible metabolic pathways
- 7. Relationship between Pharmacokinetics and Pharmacodynamics** **6 hours**
Irreversible relationship between central and effect compartments, Reversible relationship between central and effect compartments, Two-compartment pharmacokinetics with an irreversible relationship between pharmacokinetics and pharmacodynamics, Sequential responses, Isolated multi-compartment model with an irreversible relationship between the central and effect compartments, Isolated multi-compartment model with a reversible relationship between the central and effect compartments
- 8. Influence of Food on Pharmacokinetic** **4 hours**
Effects of food on gastric emptying, Effects of food on drug solubility, Effects of food on first pass metabolism
- 9. Influence of Age and Gender on Pharmacokinetics** **4 hours**
Effects of age on absorption and elimination, Effects of age on distribution, Effects of age on metabolism, Difference in distribution and metabolism, Difference in volume of distribution and metabolism, Pregnancy
- 10. Special Pharmacokinetic Considerations** **4 hours**
In renal impairments, In hepatic impairments, In other diseases

Reference Books:

1. Peter I. D. Lee and Gordon L. Amidon: *Pharmacokinetic Analysis, A Practical Approach*, 1996, Technomic Publishing Co. Inc, Lancaster.
2. Alfonso R. Gennaro: *Remington: the Science and Practice of Pharmacy*, Volume II (20th Ed.) 2002, Lippincott Williams & Wilkins, Philadelphia.
3. Leon Shargel, Alan H. Mutnick, Paul F. Souney and Larry N. Swanson: *Comprehensive Pharmacy Review* (5th Ed.) 2004, Lippincott Williams & Wilkins, Philadelphia.

PHT 302 (Credit hours 3)

Pharmaceutics VII (Pharmaceutical Engineering and Drawing)

B. Pharm., Third Year, Fifth Semester

Course Objectives:

This course will provide the students the necessary knowledge on basic pharmaceutical processes, machines applied in those processes and drawing techniques used in pharmaceutical engineering.

Course Contents:

- 1. Extraction Processes** **4 hours**
Principles, Leaching processes, Percolation, Factors affecting the efficacy of the leaching processes, Liquid-liquid extraction
- 2. Heat Transfer and Drying** **6 hours**
Principles, Heat flow processes, Conduction, Convection, Radiation, Equipment, Tray dryer, Tunnel dryer, Rotary dryer, Infrared heating, Fluidized bed dryer, Drum dryer, Spray dryer, Freeze-dryer, Factors affecting drying processes
- 3. Evaporation** **4 hours**
Principles, Factors affecting the evaporation process, Small scale methods, Large scale methods, Steam traps
- 4. Distillation** **4 hours**
Principles, Simple distillation under atmospheric pressure (small and large scale), Simple distillation under reduced pressure (small and large scale), Fractional distillation methods (small scale and boiling points diagrams), Distillation in steam (small scale and large scale)
- 5. Centrifugation** **3 hours**
Principles, Small-scale and industrial-scale centrifuges, Efficacy
- 6. Filtration** **6 hours**
Mechanism of filtration, Factors affecting the filtration rate, Methods, Sintered glass filters, Seitz filters, Membrane filters, Filter press, Metafilter, Drum filter, Air filtration
- 7. Comminution, Sizing and Handling of Powders** **9 hours**
Principles of size reduction, Comminution machinery, Sieving and sifting, Efficacy and factors affecting size reduction, Determination of particle size, Handling properties of powders (sliding and flow), Screening and sieving, Mixing of powders, Granulation of powders, Transport, Dust control
- 8. Flow of Fluids** **4 hours**
Principles, Fluid friction, Rheology and rheological properties measurements, Transportation of fluids, Mixing of liquid-liquid system, Homogenization, Pumps, Transportation of gases
- 9. Specific considerations** **5 hours**
Materials used in pharmaceutical manufacturing, Humidity control, Refrigeration, Sterile production, GMP and GLP

Reference Books:

1. E. A. Rowllins: *Bentley's Textbook of Pharmaceutics* (8th Ed.) 2001, Bailliere Tindall, London.
2. Leon Lachman, Herbert A. Lieberman and Joseph L. Kanig: *The Theory and Practice of Industrial Pharmacy* (3rd Ed.) 1987, Varghese Publishing House, Bombay.
3. Sidney H. Willig: *Good Manufacturing Practices in Pharmaceuticals* (5th Ed.) 2001, Marcel Dekker, New York.

PHL 311 (Credit hours 3)

Pharmacology I (Therapeutics)

B. Pharm., Third Year, Fifth Semester

Course Objectives:

The students will become familiar with pharmacological principles of therapeutics, and pharmacology of drugs acting on specific systems/organs in the body (I).

Course Contents:

1. General Principles

3 hours

Principles of therapeutics, Principles of toxicology, Pharmacodynamics

2. Drugs Acting on Neuroeffector Junctional Sites

10 hours

Neurohumoral transmission and autonomic and somatic motor nervous system, Cholinergic agonists, Anticholinesterase agents, Atropine, Scopolamine and other antimuscarinic drugs, Agents acting at the neuromuscular junction and autonomic ganglia, Catecholamines and sympathomimetic drugs, Adrenergic receptor antagonists

3. Drugs Acting on the CNS

10 hours

Neurohumoral transmission and CNS, Principles of anesthesiology, General anesthetics, Local anesthetics, Therapeutic gases, Hypnotics and sedatives, Drugs for treatment of psychiatric disorders, Antiepileptics, Antiparkinsonics, Opioid analgesics and Antagonist, Drug addiction and abuse

4. Drug Therapy of Inflammation

10 hours

Introduction to autoacoids, Histamine, bradykinin, 5-hydroxytryptamine and their antagonists, Lipid-derived autoacoids, Antiasthmatic drugs, Analgesic-antipyretic and antiinflammatory agents, Drugs in treatment of rheumatoid arthritis and gout

5. Hormones and Hormone Antagonists

6 hours

Introduction, Adenohypophyseal hormones and related substances, Thyroid and antithyroid drugs, estrogens and progestins, Androgens, Adrenocortical steroids and their synthetic analogs, Inhibitors of the synthesis and actions of adrenocortical hormones, Insulin, Oral hypoglycemic agents, Agents affecting calcification

6. Vitamins

3 hours

Introduction, Water-soluble vitamins, Fat-soluble vitamins

7. Dermatological Pharmacology

3 hours

Corticosteroids, Retinoids, Photochemotherapy, Antimicrobial agents, Antifungal agents

Reference Books:

1. Joel G. Hardman, Lee E. Limbird and Alfred Goodman Gilman: *Goodman and Gilman's The Pharmacological Basis of Therapeutics* (10th Ed.) 2001, McGraw-Hill, New York.
2. Bertram G. Katzung: *Basic and Clinical Pharmacology* (7th Ed.) 1998, Lange Medical Books/McGraw-Hill, New York.
3. H. P. Rang, M. M. Dale and J. M. Ritter: *Pharmacology* (4th Ed.) 1999, Churchill Livingstone, Edinburgh.

APL 331 (Credit hours 3)

Anatomy and Physiology III (Pathophysiology)

B. Pharm., Third Year, Fifth Semester

Course Objectives:

This course will provide the students basic knowledge on pathophysiology of most common disease and basic clinical tests applied in their diagnostics.

Course Contents:

- 1. Cardinal Manifestations and Presentation of Diseases** **4 hours**
Pain, Alterations in body temperature, Nervous system dysfunctions, Alterations in circulatory and respiratory functions, Alterations in gastrointestinal functions, Alterations in renal and urinary tract function, Hematologic alterations
- 2. Genetics and Disease** **3 hours**
Chromosome disorders, Diseases caused by genetic defects of mitochondria, Gene therapy
- 3. Oncology and Hematology** **3 hours**
Neoplastic disorders, disorders of hematopoiesis, disorders of hemostasis
- 4. Infectious diseases** **6 hours**
Basic considerations, Clinical syndromes; community-acquired infections, Clinical syndromes: nosocomial infections, Bacterial diseases, Mycobacterial diseases, Spirochetal diseases, Ricketial, Mycoplasma and Chlamidia, Viral diseases, Fungal infections, Protozoal and helminthic infections
- 5. Disorders of the Cardiovascular System** **3 hours**
Disorders of rhythm, Disorders of the heart, Vascular Diseases
- 6. Disorders of the Respiratory system** **3 hours**
Asthma, Environmental lung diseases, Pneumonia, Cystic fibrosis, Disorders of ventilation, Acute Respiratory Distress Syndrome, Mechanical ventilatory support
- 7. Disorders of the Kidney and Urinary Tract** **3 hours**
Disturbances of renal function, Acute renal failure, Chronic Renal failure, Transplantation, Urinary tract infections and obstruction
- 8. Disorders of the Gastrointestinal System** **3 hours**
Disorders of the alimentary tract, Liver and biliary tract diseases, Disorders of pancreas
- 9. Disorders of the Immune System, Connective Tissue and Joints** **3 hours**
Disorders of the immune system, Disorders of immune-mediated injury, Disorders of the joints
- 10. Neurologic Disorders** **4 hours**
Diseases of the CNS, Disorders of Nerve and Muscles, Psychiatric disorders, Alcoholism and drug abuse
- 11. Illnesses due to Poisons, Drug Overdosage and Envenomation** **2 hours**
Poisoning, Drug Overdosage, Reptile Bites, Ectoparasite infestations, Arthropod bites and stings
- 12. Clinical Laboratory Tests** **8 hours**
General Principles, Hematological tests- RBCs, WBCs, Common serum enzyme tests: creatine kinase, lactate dehydrogenase, alkaline phosphatase, Aspartate aminotransferase, alanine aminotransferase, Liver function tests: liver enzymes, serum bilirubin, serum proteins, Urinalysis: appearance, pH, specific gravity, protein, glucose, ketones, evaluation and microscopic examination, Common renal function tests: BUN, serum creatinine, creatinine clearance, Electrolytes: sodium, potassium, chloride, Minerals: calcium, phosphate, magnesium

Reference Books:

1. Eugene Braunwald, Anthony S. Fauci, , Dennis L. Kasper, Stephen L Hauser, Dan L. Longo, and J. Larry Jameson: *Harrison's Principles of Internal Medicine*, Volume 1 and 2 (15th Ed.) 2001, McGraw Hill, New York.
2. Harsh Mohan: *Textbook of Pathology* (4th Ed.) 2000, Jaypee Brothers Medical Publishers, New Delhi.
3. Leon Shargel, Alan H. Mutnick, Paul F. Souney and Larry N. Swanson: *Comprehensive Pharmacy Review* (5th Ed.) 2004, Lippincott Williams & Wilkins, Philadelphia.

PHC 371(Credit hours 3)

**Pharmaceutical Chemistry VI
(Name Reactions)**

B. Pharm., Third Year, Fifth Semester

Course Contents:

45 hours

Introductory study of glossary of at least 40 name reactions with their application in relevant field of pharmaceuticals, their simple mechanism and utilities of the synthetic reagents involved therein under the heading of reaction types

1. Oxidation-reduction,
2. Condensation
3. Substitutions
4. Rearrangement
5. Addition
6. Elimination

Reference Books:

1. Jerry March: *Advanced Organic Chemistry* (4th Ed.) 1999, John Wiley and Sons, New York.
2. Robert Thorton Morrison and Robert Neilson Boyd: *Organic Chemistry* (6th Ed.) 1999, Prentice Hall of India, New Delhi.
3. Peter Sykes: *Mechanisms in Organic Chemistry* (6th Ed.) 2000, Orient Longman, New Delhi.

PHG 381 (Credit hours 3)

Pharmacognosy IV (Natural Products Chemistry)

B. Pharm., Third Year, Fifth Semester

Course Objectives:

The student will become familiar with pharmacognostic principles of natural product chemistry applied in the development of drugs from natural (plant) origin.

Course Contents:

- 1. Discovering New Drugs from Higher Plants by Pharmacological Screening** **3 hours**
Introduction, Principles, Problems, Perspectives
- 2. Pharmacological Screening Programs for Plant Extracts** **12 hours**
Random selection approach, Selection of plants containing specific types of chemical compounds, Selection of plants based on a combination of criteria, Ideal requirements for a primary screen, Multidimensional primary screening, Multidimensional secondary screening of extracts and pure compounds, Tertiary evaluation, Computerized programs, Problems: sample variation, unexpected dose-response relationship, variation within sample, failures to achieve positive results, Prospects for the future
- 3. Experimental and Clinical Data for Antitumor and Cytotoxic Agents from Plants** **3 hours**
Terpenoids, Miscellaneous Compounds, Alkaloids, Others
- 4. Recent Advances in the Field of Antibiotics** **3 hours**
Acetate/propionate-derived metabolites, Isoprenoid metabolites, Amino acid-derived metabolites, Genetic engineering
- 5. Plant Mono-, Di- and Sesquiterpenoids with Pharmacological Activities** **4 hours**
General biological properties, Monoterpenes, Sesquiterpenes and Diterpenes
- 6. Saponins with Biological and Pharmacological Activity** **3 hours**
Saponins of different plant origins, General properties, Future
- 7. Principles Related to the Commercial Production, Quality and Standardization of Natural Products** **8 hours**
Commerce in crude drugs, Production of crude drugs, Plant growth regulators, Plant cell and tissue culture; biological conversions; clonal propagation, Phytochemical variation within a species, Detoriation of stored drugs, Quality control
- 8. The Modification of Natural Substances in the Modern Drug Synthesis** **6 hours**
Steroids and prostanoids, Chemotherapy, Claviceps Purpurea, Opiates, Cannabinoids, Natural substances as raw material for drug synthesis
- 9. Current Trends** **3 hours**
Plant products and High Throughput, Biologically active compounds from marine organisms, Traditional plant medicine as a source of new drugs

Reference Books:

1. H. Wagner and P. Wolff: *New Natural Products and Plant Drugs with Pharmacological, Biological or Therapeutical Activity*, 1977, Springer-Verlag, Berlin.
2. W. C. Evans: *Trease and Evans Pharmacognosy* (15th Ed.) 2002, W. B. Saunders, Edinburgh.
3. Hans-Joachim Boehm, Gerhard Klebe and Hugo Kubinyi: *Wirkstoffdesign, Der Weg zum Arzneimittel*, 2002, Spektrum Akademischer Verlag, Heidelberg, (in German).
4. Paul M. Dewick: *Medicinal Natural Products, A Biosynthetic Approach* (2nd Ed.) 2002, J. Wiley and Sons, Chichester.

LAB 11 (Credit hours 1)

Pharmaceutical Laboratory-11 (Pharmaceutics)

B. Pharm., Third Year, Fifth Semester

Course Objectives:

The student will become familiar with the basic principles of pharmacokinetic and pharmacodynamic in vitro (laboratory) conditions

Course Content:

1. Tablet dissolution rate
2. Partition coefficient
3. Accelerated stability testing
4. Hydrolysis in parenterals
5. Adsorption processes
6. Time constants in pharmacokinetics
7. AUC determination
8. Bioequivalence studies
9. Half-exchange method (*in vitro* determination)

LAB 12 (Credit hours 1)

Pharmaceutical Laboratory-12 (Pharmaceutical Microbiology)

B. Pharm., Third Year, Fifth Semester

Course Objectives:

The student will become familiar with the basic microbiological techniques and tests.

Course Content:

1. Measurements of antimicrobial activity
2. Antibiotic assays – agar diffusion assays
3. Antibiotic assays – turbidimetric assays
4. MIC test methods
5. Counting of microorganism in given pharmaceutical products (at least three)
6. Preservative efficacy tests
7. Disinfectant evaluation
8. Interpretation of results according to Pharmacopoeial requirements and statistical evaluation
9. Microbiological assay of vitamins

Reference book:

W. B. Hugo and A. D. Russel: *Pharmaceutical Microbiology* (6th Ed.) 1998, Blackwell Scientific Publication, Oxford.

LAB 13 (Credit hours 1)

Pharmaceutical Laboratory-13 (Instrumental Analysis)

B. Pharm., Third Year, Fifth Semester

Course Objectives: *The student will become familiar with the basic analytical instruments*

Course Content:

1. pH Meter
2. Conductivity
3. Potentiometry
4. Colourimetry
5. UV
6. HPLC
7. Flame Photometer

Reference book:

Kenneth A. Connors: *Textbook of Pharmaceutical Analysis* (3rd Ed.) 2002, John Wiley and Sons, New York.

SEM-4 (Credit hour 1)

Pharmaceutical Seminar-4

B. Pharm., Third Year, Fifth Semester

**B. Pharm.
Third Year
Sixth Semester**

PHT 303 (Credit hours 3)

Pharmaceutics VIII (Industrial Pharmacy)

B. Pharm., Third Year, Sixth Semester

Course Objectives:

Through this course the student will learn the principles of industrial production of drugs, scale-up processes and packaging materials used in drug industry.

Course Contents:

- 1. Principles of Pharmaceutical Processing** **6 hours**
Mixing, Milling, drying, Compression and consolidation of powdered solids, Basic chemical principles related to emulsion and suspension dosage forms, Pharmaceutical reology, Clarification and filtration
- 2. Preformulation Testing** **4 hours**
Organoleptic properties, Purity, Particle size, shape and surface area solubility, Dissolution, Parameters affecting absorption, Crystal properties and polymorphism, Stability, Miscellaneous properties, Examples of preformulation studies
- 3. Pharmaceutical Dosage Form Design -Tablets** **10 hours**
Tablet formulation and design, Compressed tablets by wet granulation, Compressed tablets by direct compression, Compression-coated and layer tablets, Effervescent tablets, Special tablets, Chewable tablets, Medicated lozenges, Quality assurance
- 4. Pharmaceutical Dosage Form Design –Capsules** **4 hours**
Hard capsules, Soft gelatin capsules, Microencapsulation
- 5. Sustained Release Dosage Forms** **5 hours**
Design, Zero-order release, First-order release, Multiple dosing, Approaches based on drug modification, Approaches based on dosage form modification, Product evaluation and testing, Drug complexes, Granules, Matrix tablets, Controlled release technology
- 6. Pharmaceutical Dosage Form Design – Others** **6 hours**
Liquids, Pharmaceutical suspensions, Emulsions, Semisolids, Suppositories, Pharmaceutical aerosols, Sterile products
- 7. Product Processing, Packaging, Evaluation and Regulations** **10 hours**
Pilot plant scale-up techniques, Packaging materials science, Production management, Kinetic principles and stability testing, Quality control and Assurance, Drug regulatory affairs

Reference Books:

1. Leon Lachman, Herbert A. Lieberman and Joseph L. Kanig: *The Theory and Practice of Industrial Pharmacy* (3rd Ed.) 1987, Varghese Publishing House, Bombay.
2. Sidney H. Willig: *Good Manufacturing Practices in Pharmaceuticals* (5th Ed.) 2001, Marcel Dekker, New York.
3. Herbert A. Lieberman, Leon Lachman and Joseph B. Schwartz: *Pharmaceutical Dosage Forms: Tablets*, Volume 1 1989, Marcel Dekker, New York.
4. Herbert A. Lieberman, Leon Lachman and Joseph B. Schwartz: *Pharmaceutical Dosage Forms: Tablets*, Volume 2 1990, Marcel Dekker, New York.
5. Herbert A. Lieberman, Martin M. Rieger and Gilbert S. Banker: *Pharmaceutical Dosage Forms: Disperse Systems*, Volume 3 1998, Marcel Dekker, New York.

PHT 304 (Credit hours 3)

Pharmaceutics IX (Hospital Pharmacy)

B. Pharm., Third Year, Sixth Semester

Course Objectives:

The students will become familiar with the organization and specificity of hospital pharmacy, responsibilities and duties of hospital pharmacist, as well as drug monitoring processes in hospital.

Course Contents:

- 1. Hospital Organization** **8 hours**
The hospital, Uniqueness of hospital pharmacy, Patients self-administration of drugs in hospitals, Investigational drugs, Store room arrangements, Emergency and antidotal cabinet, Poison control, Narcotics, Radiopharmaceuticals, Regulations, Technology and automation in hospital pharmacy, Future practice
- 2. Responsibilities of Hospital Pharmacist** **14 hours**
Standards of practice, Dispensing to in-door and out-door patients, Intravenous admixtures, Cytotoxic drugs dispensing, Handling of radiopharmaceuticals, Sterile production, Hospital Formulary, Prepackaging and manufacturing in hospital, Computers in hospital pharmacy
- 3. Adverse Drug Reaction** **6 hours**
Incidence and scope of the problem, Causes and classification, Impact on health-care costs, Monitoring and prevention
- 4. Long-Term Care Facilities** **4 hours**
Background, The right to health, Impact of growing elderly population, Long-term care facilities, Extended-care facilities, Skilled nursing facilities, Intermediate care facilities, Care of mentally retarded, Pharmacist role and functions
- 5. Nutrition and the Hospitalized Patient** **6 hours**
Nutritional problems in hospitalized patients, Nutritional assessment and metabolic requirements, Methods of support, Monitoring support, Disease-specific support, Home parenteral nutrition
- 6. Surgical Supplies** **3 hours**
Surgical dressings, Sutures and suture materials
- 7. Health Accessories in Hospital Practice** **4 hours**
Hospital beds, Respiratory therapy, Apnea programs, Phototherapy, Hypodermic equipments, Bulb syringes, Dressings and first-aid supplies, Thermometers, Blood-pressure monitors, Blood-glucose monitors, Breast pumps, Vacuum constriction devices, Ostomy appliances and supplies, Urology and incontinence supplies

Reference Books:

1. Alfonso R. Gennaro: *Remington: the Science and Practice of Pharmacy*, Volume II (20th Ed.) 2002, Lippincott Williams & Wilkins, Philadelphia.
2. William E. Hassan: *Hospital Pharmacy* (5th Ed.) 1986, Lea and Febiger, Philadelphia.
3. Roger Walker and Clive Edwards: *Clinical Pharmacy and Therapeutics* (3rd Ed.) 2003, Churchill Livingstone, London.
4. Leon Shargel, Alan H. Mutnick, Paul F. Souney and Larry N. Swanson: *Comprehensive Pharmacy Review* (5th Ed.) 2004, Lippincott Williams & Wilkins, Philadelphia.

PHL 312 (Credit hours 3)

Pharmacology II (Therapeutics)

B. Pharm., Third Year, Sixth Semester

Course Objectives:

The students will become familiar with pharmacological principles of therapeutics, and pharmacology of drugs acting on specific systems/organs in the body (II)

Course Contents

- 1. Drugs Affecting Renal Function and Electrolyte Metabolism** **6 hours**
Diuretics and other agents employed in the mobilization of edema fluid, Agents affecting the renal conservation of water, Inhibitors of tubular transport of organic compounds
- 2. Cardiovascular Drugs** **10 hours**
Renin and angiotensin, Drugs used for the treatment of angina: organic nitrates, calcium-channel blockers and β -adrenergic antagonists, Antihypertensive agents and the drug therapy of hypertension, Digitalis and allied cardiac glycosides, Antiarrhythmic drugs, Drugs used in the treatment of hyperlipoproteinemias
- 3. Drugs Affecting Gastrointestinal Function** **4 hours**
Agents for control of gastric acidity and treatment of peptic ulcers, Agents affecting gastrointestinal water flux and motility, digestants and bile acids
- 4. Drugs Affecting Uterine Motility** **2 hours**
Oxytocin, Prostaglandins, Ergot alkaloids and other drugs, Tocolytic agents
- 5. Chemotherapy of Parasitic Infections** **6 hours**
Drugs used in the chemotherapy of helminthiasis, Drugs used in the chemotherapy of protozoal infections - malaria, Drugs used in the chemotherapy of protozoal infections – amebiasis, giardiasis and trichomoniasis, Drugs used in the chemotherapy of protozoal infections – leishmaniasis, trypanosomiasis and other protozoal infections
- 6. Chemotherapy of Microbial Diseases** **10 hours**
Antimicrobial agents – general considerations, Antimicrobial agents – sulfonamides, trimethoprim-sulfamethoxazole, Quinolones and agents for urinary tract infections, Antimicrobial agents- penicillins, cephalosporines and other beta-lactam antibiotics, Antimicrobial agents – aminoglycosides, Antimicrobial agents – tetracyclines, Chloramphenicol, Erythromycin and miscellaneous antibacterial agents, Drugs used in the chemotherapy of tuberculosis and leprosy, Antifungal agents, Antiviral agents
- 7. Chemotherapy of Neoplastic Diseases** **3 hours**
Introduction, Antineoplastic agents
- 8. Drugs used for Immunosuppression** **2 hours**
Immunosuppressive agents
- 9. Drugs Acting on the Blood and Blood-forming Organs** **2 hours**
Hematopoietic agents: growth factors, minerals and vitamins, Anticoagulant, thrombolytic and antiplatelet drugs

Reference Books:

1. Joel G. Hardman, Lee E. Limbird and Alfred Goodman Gilman: *Goodman and Gilman's The Pharmacological Basis of Therapeutics* (10th Ed.) 2001, McGraw-Hill, New York.
2. Bertram G. Katzung: *Basic and Clinical Pharmacology* (7th Ed.) 1998, Lange Medical Books/McGraw-Hill, New York.
3. H. P. Rang, M. M. Dale and J. M. Ritter: *Pharmacology* (4th Ed.) 1999, Churchill Livingstone, Edinburgh.

PHC 372 (Credit hours 3)

Pharmaceutical Chemistry (Quality Assurance of Drugs)

B. Pharm., Third Year, Sixth Semester

Course Objectives:

The students will learn the principles of quality control of drugs, Pharmacopoeial assays used in quality assurance, GMP and GLP principles, ISO standardization and WHO guidelines regarding quality assurance of drugs.

Course Contents:

- 1. Quality Control of Drugs** **3 hours**
Basic principles, Testing, Properties of drug substances, Assurance of quality
- 2. Pharmacopoeial Assays for Quality Assurance of Drugs** **12 hours**
Assays for acidimetry and alkalimetry, Non-aqueous titrations, Oxidation-reduction assays, Assays by diazotization, Assays by precipitation, Complexometric assays, Gravimetric assays, Gasometric assays, Photometric assays, Assays for esters, volatile oils etc, Alkaloidal assays, Assays by the oxygen flask method, Radiochemical assays, Miscellaneous assays, Assays for biologicals
- 3. Methods Applied in Quality Testing** **10 hours**
UV and visible spectrophotometry, Fluorimetry, IR spectrophotometry, NMR, Mass spectrometry, Flame photometry, Emission spectroscopy, X-ray diffraction, Radioimmunoassay, HPLC, TLC, Biological activity assays
- 4. GMP and GLP** **10 hours**
GMP practices as per WHO guidelines, USFDA guidelines, Documentation of quality system, Approach to certification, Application for registration, Quality audit, Quality manual for operation, Quality policy, Planning
- 5. Validation** **5 hours**
Quality assurance, Validation of drug substances and reagents, Validation of equipment and analytical instruments, Validation of final products, Cost audit
- 6. ISO 9000 Series and ICH Guidelines** **5 hours**
Elements and applications of ISO 9000 systems, ISO Guide 17025, Documentation, Nepalese standards

Reference Books:

1. Quality Assurance of Pharmaceuticals: A Compendium and Related Materials, Vol. 1-2, 1997, WHO Publications.
2. L. M. Atherden: *Bentley and Driver's Textbook of Pharmaceutical Chemistry* (8th Ed.) 2001, Oxford University Press, New Delhi.
3. Kenneth A. Connors: *A Textbook of Pharmaceutical Analysis* (3rd Ed.) 2002, John Wiley and Sons, New York.
4. Sidney H. Willig: *Good Manufacturing Practices in Pharmaceuticals* (5th Ed.) 2001, Marcel Dekker, New York.
5. Alfonso R. Gennaro: *Remington: the Science and Practice of Pharmacy*, Volume I (20th Ed.) 2002, Lippincott Williams & Wilkins, Philadelphia.
6. ICH Harmonized Guidelines and WHO on Harmonization
7. ISO 9000 series

PHC 373 (Credit hours 3)

Medicinal Chemistry I (Natural Drugs)

B. Pharm., Third Year, Sixth Semester

Course Objectives:

In this course the students will learn principles of medicinal chemistry, properties of drugs affecting their biological action and therapeutic application for drugs of natural origin. (I)

Course Contents:

- 1. Introduction to Medicinal Chemistry** **6 hours**
Drug discovery, Theoretic aspects of drug design, Medicines of plant origin, Synthetic and semisynthetic drugs, Drugs of natural origin, Rational design, Genetic engineering
- 2. Physicochemical Properties in Relation to Biological Action** **8 hours**
Receptors and drug action, Drug distribution, Acid-base properties, Statistical prediction of pharmacological activity, Combinatorial chemistry, Molecular modeling (Computer-aided drug design)
- 3. Metabolic Changes of Drugs and Related Organic Compounds** **4 hours**
Role of cytochrome P-450 monooxygenase in oxidative biotransformation, Oxidative reactions, Reductive reactions, Hydrolytic reactions, Phase II or conjugation reactions, Factors affecting drug metabolism
- 4. Classification, Chemistry, Biological Action and Therapeutic Application of the following:**
 - Alkaloids** **4 hours**
Solanaceous alkaloids, Ephedrine, Nicotine, Quinine, Morphine, General methods of structure determination
 - Steroids and Therapeutically Related Compounds** **4 hours**
Chemical and physical properties of steroids, Changes to modify pharmacokinetic properties of steroids, Cholesterol and bile acids, Androgens, Estrogens, Progestins, Cortisone and hydrocortisone
 - Prostaglandins, Leukotriens and other Eicosanoids** **4 hours**
Eicosanoid biosynthesis, Drug action mediated by eicosanoids, Drug design
 - Carbohydrates** **4 hours**
Stereochemical considerations, Interrelationship with lipids and proteins, Sugar alcohols, Sugars, Starch and derivatives, Cellulose derivatives, Heparin, Glycosides
 - Amino Acids, Proteins, Enzymes and Peptide Hormones** **4 hours**
Aminoacids, Protein hydrolysates, Amino acid solutions, Protein and protein-like compounds, Enzymes, Hormones
 - Vitamins and Related Compounds** **4 hours**
Retinol, Calciferol, Thiamine, Riboflavin, Pyroxydine, Cyanocobalamine, Ascorbic acid, General survey of other vitamins, Miscellaneous considerations
 - Cardiac Glycosides** **3 hours**
Digitalis, Strothalantus group

Reference Books:

1. William O. Foye, Thomas L. Lemke and David A Williams: *Principles of Medicinal Chemistry* (4th Ed.) 1995, Lippincott Williams and Wilkins, Philadelphia.
2. Jaime N. Delgado and William A. Remers: *Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry* (10th Ed.) 1998, Lippincott-Raven Publishers, Philadelphia.
3. Hans-Joachim Boehm, Gerhard Klebe and Hugo Kubinyi: *Wirkstoffdesign, Der Weg zum Arzneimittel*, Spektrum Akademisher Verlag, Hedelberg, 2002. (in German)

PHG 382 (Credit hours 3)

Pharmacognosy V (Himalayan Crude Drugs)

B. Pharm., Third Year, Sixth Semester

Course Objectives:

This course will provide students with knowledge on Himalayan crude drugs traditionally used in local healing traditions.

Course Contents:

45 hours

Studies on at least 30 Natural Drugs available and used in Nepal (Self Directive course)

Nomenclature, Biological Source, Habitat, Cultivation and Collection, Macroscopical Characters, Microscopical Characters, Chemical constituents, Pharmacological action, Pharmacopoeal standard, Commercial value, Formulations

Reference:

1. Kamal K. Joshi and Sanu D Joshi: *Genetic Heritage of Medicinal and Aromatic Plants of Nepal Himalayas 2001*, Buddha Academic Publishers and Distributors, Kathmandu.
2. W. C. Evans: *Trease and Evans Pharmacognosy* (15th Ed.) 2002, W. B. Saunders, Edinburgh.
3. Indian Pharmacopoeia
4. Japanese Pharmacopoeia
5. Chinese Pharmacopoeia

LAB-14 (Credit hour 1)

Pharmaceutical Laboratory-14 (Pharmacology)

B. Pharm., Third Year, Sixth Semester

Course Objectives: *The students will become familiar with the basic pharmacological experiments of in vitro and in vivo conditions.*

Course Content

1. Basic physiological tests and preclinical pharmacological testing (*in vitro*)
2. Clinical pharmacological testing in (animal model – *in vivo*)
3. Local and systemic anesthetics
4. Opioid and nonopioid analgesics
5. Diuretics and antidiuretics
6. Blood glucose level determination in mice model - Antidiabetics

Reference Books:

LAB-15 (Credit hour 1)

Pharmaceutical Laboratory-15 (Quality Assurance)

B. Pharm., Third Year, Sixth Semester

Course Objectives: *Student will learn simple preparation and pharmacopoeial standard of some pharmaceutical products.*

Course Content

1. Identification
2. Purity testing
3. Drug content determination
4. Instrumental analysis in quality control
 - a) HPLC
 - b) Spectrophotometry
 - c) Thin layer chromatography

Reference Books:

1. Japanese Pharmacopoeia XIII
2. Indian Pharmacopoeia (1996)

LAB-16 (Credit hour 1)

Pharmaceutical Laboratory 16 (Medicinal Chemistry of Plants)

B. Pharm., Third Year, Sixth Semester

Course Objectives: *Student will learn the principles of active ingredient isolation from plant material*

Course Content

1. L-ascorbic acid content in three medicinal plants
2. Isolation of Caffeine
3. Cardiac glycosides isolation
4. Glycirizin isolation

Reference Books:

SEM-5 (Credit hour 1)

Pharmaceutical Seminar-5

B. Pharm., Third Year, Sixth Semester

**B. Pharm.
Fourth Year
Seventh Semester**

PHT 401 (Credit hours 3)

Pharmaceutics X (Cosmetology)

B. Pharm., Fourth Year, Seventh Semester

Course Objectives:

This course will provide students with the knowledge on cosmetic sciences and manufacturing of cosmetic products, as well as necessary safety and quality assurance requirements.

Course Contents:

- 1. History of Cosmetics and Principles of Cosmetology** **3 hours**
General cosmetology, Decorative cosmetology, Medicinal cosmetology
- 2. Anatomical and Physiological Bases for Cosmetics** **8 hours**
Skin, Pigmentation, Anomalies, Types of skin, Skin ageing, Percutaneous absorption of cosmetic products, Hair, Anomalies in growth, Nail, Tooth, Sense of smell
- 3. Substances Used in Cosmetic Products** **6 hours**
Natural substances, Semi-synthetic substances, Synthetic substances, Surfactants, Emollients, Hydrocolloids, Preservatives, Antioxidants, Colors, UV-filters, Packaging material
- 4. Cleansing products** **6 hours**
Soaps, Baths, Shower gels, Shampoos, Products for intimate hygiene, Products for skin cleansing, Oral dental care products
- 5. Protective Cosmetics** **8 hours**
Skin-care products, Lip-care products, Hand-care products, Foot-care products, Hair-care products, Tooth-care products, Child-care products, Man's cosmetics, UV filters in skin protection, Sun screen factors, Insect repellents
- 6. Decorative Cosmetics** **5 hours**
Foundations, Decorative powders, Make up products, Eye cosmetics, Hair cosmetics, Nail cosmetics, Depilators
- 7. Scents** **3 hours**
Classification, Characteristics, Packaging
- 8. Adverse Reactions to Cosmetics and Cosmetics Regulations** **3 hours**
Hypoallergenic products, Legal distinction between cosmetics and drugs
- 9. Medicinal Cosmetology** **3 hours**
Cosmeceuticals

Reference Books:

1. Tsuneo Mitsui: *New Cosmetic Science*, 1997, Elsevier, Amsterdam.
2. Peter Elsner and Howard I. Maibach: *Cosmeceuticals, Drugs vs Cosmetics*, 2000, Marcel Dekker, New York.
3. Vijay Malik: *Drugs and Cosmetic Act* (16th Ed.) 2003, Eastern Book Company, Lucknow.

PHT 402 (Credit hours 3)

Pharmaceutics XI (Clinical Pharmacy)

B. Pharm., Fourth Year, Seventh Semester

Course Objectives:

In this course the students will learn the principles of clinical pharmacy, the present situation in the field and the future perspectives of clinical pharmacist.

Course Contents:

- 1. Pharmacist-patient Relationship** **4 hours**
Taking the medication history, Active listening, Ethics, Special treatments for "stigmatized patients"
- 2. Organization of Clinical Pharmacy** **4 hours**
Pharmacist-physician-nurse relationship, Pharmacist and therapeutic committee, Patient-focused care, Hospital medication orders
- 3. Rational Dosage Regimens** **10 hours**
Clinical pharmacokinetics, Therapeutic drug monitoring, Patient drug profile forms, RUD, WHO list of Essential Drugs applied to Nepal, Cost-effectiveness monitoring, Information technology, Perspectives
- 3. Drug interactions** **8 hours**
Drug-drug interactions, Drug-pharmaceutical ingredients interaction, Admixtures, Drug induced modifications of laboratory test values
- 4. Adverse Drug Reactions** **8 hours**
Local reactions, Systemic reactions, Drug induced diseases, Reporting of known and newly discovered side effects
- 5. Investigational drugs** **6 hours**
Clinical trials, Regulations, Conclusions
- 6. Special considerations** **5 hours**
Cancer patients, Elderly patients, Infants, Pregnant patients, Nursing mothers, AIDS patients, Tuberculosis patients, Leprosy patients

Reference Books:

1. Roger Walker and Clive Edwards: *Clinical Pharmacy and Therapeutics*, 2003, Churchill Livingstone, Edinburgh.
2. G. Parthasarathi, Karin Nyfort-Hansen and Milan C Nahata: *A Textbook of Clinical Pharmacy Practice*, 2004, Orient Longan, Chennai.
3. Alfonso R. Gennaro: *Remington: The Science and Practice of Pharmacy*, Volume II (20th Ed.) 2002, Lippincott Williams & Wilkins, Philadelphia.
4. A. J. Winfield and R. M. E. Richards: *Pharmaceutical Practice* (2nd Ed.) 1998, Churchill Livingstone, Edinburgh.

PHL 411 (Credit hours 3)

Pharmacology III (Therapeutics and Toxicology)

B. Pharm., Fourth Year, Seventh Semester

Course Objectives:

The emphasis of this course is to teach the principles of drug-related toxicity, toxic agents and environmental toxicology and regulations on risk assessment.

Course Contents:

- 1. General Principles of Toxicology** **4 hours**
History, Principles of toxicology, Mechanism of toxicity, Risk assessment
- 2. Disposition of Toxicants** **6 hours**
Absorption, distribution and excretion of toxicants, Biotransformation of xenobiotics, Toxicokinetics
- 3. Nonorgan-directed Toxicity** **4 hours**
Chemical carcinogenesis, Genetic toxicology, Developmental toxicology
- 4. Target Organ Toxicity** **10 hours**
Toxic responses to blood, Toxic responses to immune system, Toxic responses to liver, Toxic responses to kidney, Toxic responses to respiratory system, Toxic responses to nervous system, Toxic responses to heart and vascular system, Toxic responses to skin, Toxic responses to reproductive system, Toxic responses to eye, Toxic responses to endocrine system
- 5. Toxic Agents** **8 hours**
Toxic effects of pesticides, Toxic effects of metals, Toxic effects of solvents and vapors, Toxic effects of radiation and radioactive materials, Toxic effects of animal toxins, Toxic effects of plants
- 6. Environmental Toxicology** **5 hours**
Air pollution, Aquatic and terrestrial ecotoxicology
- 7. Applications of Toxicology** **8 hours**
Food toxicology, Forensic toxicology, Clinical toxicology, Occupational toxicology, Regulatory toxicology

Reference Books:

1. Curtis D. Klaassen: *Casertt and Doull's Toxicology, The Basic Science of Poisons* (5th Ed.) 1996, McGraw Hill, New York.
2. Melanie Johns Cupp: *Toxicology and Clinical Pharmacology of Herbal Products*, 2000, Humana Press, New Jersey.
3. Alkalank Kumar Jain: *Drugs and Cosmetics* (7th Ed.) 2004, Alkalank Publications, New Delhi.
4. C. K. Parikh: *Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology* (6th Ed.) 1999, CBC Publishers, New Delhi.

PHC 471 (Credit hours 3)

Medicinal Chemistry II (Synthetic Drugs)

B. Pharm., Fourth Year, Seventh Semester

Course Objectives:

In this course the students will learn the principles of medicinal chemistry, properties of drugs affecting their biological action and therapeutic application for drugs of synthetic origin. (II)

Course Contents:

- 1. Synthetic Drugs** **2 hours**
Classification of synthetic drugs, drug design and recent approaches to the synthesis of drugs
- 2. Chemistry, Biological Action and Therapeutic Application of the following:**
Analgesics and Antipyretics **2 hours**
Morphine derivatives, Antitussive agents, Anti-inflammatory analgesics, Antipyretics
- Local and General Anesthetics** **3 hours**
Mechanism of action, Administration, Factors affecting effectiveness, Rate of onset and duration of anesthesia, Secondary pharmacological action, Structure-action relationship
- Sulfonamides, Sulfons and Folate Reductase Inhibitors with Antibacterial Action** **3 hours**
Sulfonamides and folate reductase inhibitors, Well-absorbed, Short- and Intermediate-acting sulfonamides, Sulfonamides for ophthalmic infections, Sulfonamides for burn therapy, Sulfonamides for intestinal infections, ulcerative colitis or reduction of bowel flora, Sulfones
- Anti-infective Agents, Antibiotics and Antiviral Agents** **8 hours**
Local anti-infective agents, Alcohols and related compounds, Phenols and their derivatives, Oxidizing agents, Halogen-containing compounds, Chlorine-containing compounds, Cationic surfactants, Dyes, Mercury compounds, Preservatives, Antifungal agents and antibacterial agents, Antibiotics-overview, β -lactam antibiotics, Aminoglycosides, Tetracyclines, Macrolides, Lincomycins, Polypeptides, Antitubercular drugs, Antiprotozoal drugs, Anthelmintics, Antiscabious and antipedicular agents, Antiviral agents
- Antimalarials** **2 hours**
Modern malarial therapy, Malaria vaccine, Synthetic antimalarial drugs
- Antihistamines** **3 hours**
Histamine H₁-receptor antagonists, Inhibition of histamine release, Histamine H₂-receptor antagonists, Histamine H₃-receptor ligands
- Antineoplastic agents** **3 hours**
Tumor cell properties, Alkylating agents, Antimetabolites, Antibiotics, Hormones, Immunotherapy, Future antineoplastic drugs
- Diuretics** **3 hours**
Site 1 diuretics-carbonic anhydrase inhibitors, Site 3 diuretics-thiazide and thiazide-like diuretics, Site-2 diuretics-high-ceiling or loop diuretics, Site 4 diuretics-potassium-sparing diuretics, Miscellaneous diuretics
- Cardiovascular Agents of Synthetic Origin** **3 hours**
Antianginal agents and vasodilators, Antiarrhythmic drugs, Antihypertensive drugs, Antihyperlipidemic agents, Anticoagulants, Hypoglycemic agents, Thyroid hormones antithyroid drugs
- CNS Depressants and CNS Stimulants** **4 hours**
Mechanism of action, Anxiolytics, Sedative and hypnotic agents, CNS depressant with skeletal muscle relaxant properties, Antipsychotic, Anticonvulsant or Antiepileptic drugs, Analeptics, Methylxanthines, Central sympathomimetic agents, Monamine oxidase inhibitors, Tricyclic antidepressant compounds, Psychedelics

Adrenergic agents and cholinergic drugs**4 hours**

Drugs affecting adrenergic neurotransmitters, Sympathomimetic agents, Adrenergic receptor antagonists, Cholinergic agonists, Cholinergic receptor antagonists, Cholinergic blocking agents, Parasympathetic postganglionic blocking agents, Ganglionic blocking agents, neuromuscular blocking agents

Prodrugs**2 hours**

Basic concepts, Prodrugs of functional groups, Bioprecursor prodrugs, Chemical Delivery Systems

Biotechnology and Drug Discovery**3 hours**

Cloning DNA, New biological targets for drug development, Novel drug-screening techniques, Novel biological agents, Antibodies, Antisense oligonucleotide therapy, Gene therapy, Products

Reference Books:

1. Jaime N. Delgado and William A. Remers: *Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry* (10th Ed.) 1998, Lippincott-Raven Publishers, Philadelphia.
2. William O. Foye, Thomas L. Lemke and David A Williams: *Principles of Medicinal Chemistry* (4th Ed.) 1995, Lippincott Williams and Wilkins, Philadelphia.
3. Gorg Walsh: *Biopharmaceuticals, Biochemicals and Biotechnology* (2nd Ed.) 2003, John Wiley and Sons, Chichester.

PHG 481 (Credit hours 3)

Pharmacognosy VI (Traditional System of Medicine)

B. Pharm., Fourth Year, Seventh Semester

Course Objectives:

This course will provide students with knowledge on traditional systems of medicine practiced in Asia.

Course Contents:

- 1. Traditional Systems of Medicine: Concept and Overview** **4 hours**
Historical background, Concepts, Evidence of efficacy, Quality control, Legal aspects, Safety, Concept and Traditional and alternative system
- 2. Ayurveda** **18 hours**
Evolution of Ayurveda, Natural philosophy, Bioregulating principles: Tridosha, The interior of the body and the digestive processes, Understanding tastes: Rasas, Pathology in Ayurveda, Diagnostic methodology in Ayurveda: Nidana, General principles of treatment: Chikitsa, The Panchakarma therapy, Pharmaceutical preparations used in Ayurveda therapy, Rasashastra, Nadivigyana, Nadi, Prana, Healthy living according to Ayurveda, Globalization of Ayurveda
- 3. Tibetan Traditional Medicine** **6 hours**
Tibetan medical philosophy, Disease, Diagnosis, Treatment, Common Tibetan prescriptions, Behavioral therapy
- 4. Chinese Traditional Medicine** **6 hours**
Origins and development, Tao and Yin-Yang philosophy, Five elements, Essential substances, Organs, Meridian system, Disease causation, Diagnosis and Differentiation, Therapeutic modalities and ideas, Chinese herbal drugs
- 4. Kampo Medicine** **3 hours**
Concept, Stages of disease, Clinical examination, Diagnosis, Kampo prescriptions
- 5. Homeopathy and Aromatherapy** **4 hours**
Origins, Prescribing, Dispensing, Materia Medica, In practice, Aromatherapy, Applications, Essential oils
- 6. Nepalese Healing Traditions** **4 hours**
Traditional tribal healers, Ethnic specificity, Classification, Recording and future

Reference Books:

1. Ashok Majumdar: Ayurveda, *The Ancient Indian Science of Healing*, 1988, Wheeler Publishing, New Delhi.
2. M. Abdul Kareem: *Plants in Ayurveda*, 1997, Foundation for Revitalization of Local Healing Traditions, Bangalore.
3. Tom Dummer: *Tibetan Medicine and other holistic health-care systems*, 1998, Paljor Publications, New Delhi.
4. Robert Svoboda and Arnie Lade: *Tao and Dharma, Chinese Medicine and Ayurveda*, 1995, Lotus Press, Twin Lakes.
5. Tapan C. Mondal: *Textbook of Homoeopathic Materia Medica*, 2000, Books and Allied Ltd., Calcutta.
6. *Medicinal Plants of Nepal*, 1997, Bulletin of the Department of Medicinal Plants, No. 3, His Majesty's Govt. of Nepal, Ministry of Forests and Soil Conservation, Department of Plant Resources, Kathmandu.
7. Kamal K. Joshi and Sanu D. Joshi: *Genetic Heritage of Medicinal and Aromatic Plants of Nepal Himalayas*, 2001, Buddha Academic Publishers and Distributors, Kathmandu.

RES 491 (Credit hours 3)

Pharmaceutical Research

B. Pharm., Fourth Year, Seventh Semester

Course Objectives:

The course will enable students to independently search the relevant pharmaceutical literature, and write a research project based on scientific background. The research project will be submitted to relevant authorities.

Course Contents:

- 1. Medline and Related Data Bases** **7 hours**
Introduction to literature search, Key words, Medline, PubMed, SCI, Current Contents, Chemical Abstracts, Biological Abstracts,
- 2. Pharmaceutical and Pharmacy-related Publications** **7 hours**
The most quoted journals, Original research article, Review article, Short communication, Notes, Rapid communication, Conferences, congresses and symposiums, Workshops
- 3. Research Article** **5 hours**
Summary, Key words, Introduction, Materials and methods, Results, Discussion, Conclusions, References
- 4. Patents** **3 hours**
Patent, Access to patents, Citation of a patent, Expired patents
- 5. Writing a Research Proposal*** **23 hours**
Literature search, Originality, Applicability to the available resources, Time-frame, Report, Publications

* Four students are jointly writing a proposal under the supervision of a teacher. The proposal will be submitted to the relevant authorities.

LAB-17 (Credit hour 1)

Pharmaceutical Laboratory-17 (Cosmetology)

B. Pharm., Fourth Year, Seventh Semester

Course Objectives: *The students will manufacture cosmetic products ex temporarily and characterize them.*

Course Contents:

- | | |
|---|--|
| 1. Cleansing and protective skin creams | 6. Hair cosmetics: gel and shampoo |
| 2. pH-determination and emulsion type determination | 7. Deodorants and liquid hand soaps |
| 3. Lotions | 8. Tooth paste and mouth wash |
| 4. Stability testing of lotions and ointments | 9. Cosmetics based on natural origin ingredients |
| 5. Decorative powders | 10. Nail cosmetics |

Reference Books:

1. Tsuneo Mitsui: *New Cosmetic Science*, 1997, Elsevier, Amsterdam.

LAB-18 (Credit hour 1)

Pharmaceutical Laboratory-18 (Toxicology)

B. Pharm., Fourth Year, Seventh Semester

Course Objectives: *Introduction to basic toxicological practice in in vitro and in vivo conditions*

Course Contents:

Estimation of arsenic in tap water, carbon monoxide in air, LD50 of some commonly used drugs, carcinogenic properties of certain PCs, , toxic effect of dioxane and case study of poisonous deathand toxicological evidence of pharmaceutical products through local hospital.

Reference Books:

LAB-19 (Credit hour 1)

Pharmaceutical Laboratory-19 (Traditional Systems of Medicine: Formulations)

B. Pharm., Fourth Year, Seventh Semester

Course Objectives: *Students will become familiar with Ayurvedic, Unani and Tibetan medicinal formulations and specificity of their preparations (some examples are given below)*

- | | |
|-------------------------|----------------------|
| 1. SHARBAT NARANJ | 5. TRIPHALA CHURNA |
| 2. ROGHAN BAIZA-I-MURGH | 6. HAB PAPE ETA |
| 3. SUFUF BARQ | 7. ITRIFAL KISHMISHI |
| 4. SITOPALADI CHURNA | 8. VASAVALEHA |

Reference Books:

1. Hakim Mohammad Said: *Hamdard Pharmacopoeia of Eastern Medicines* (2nd Ed.) 1997 Sri Satguru Publications, Delhi.
2. Chandra Raj Sapkota (2000) *Ayurveda Medicine Production Science*, NPTC, Kathmandu

SEM-6 (Credit hour 1)

Pharmaceutical Seminar-6

B. Pharm., Fourth Year, Seventh Semester

**B. Pharm.
Fourth Year
Eighth Semester**

PHT 403 (Credit hours 3)

Social Pharmacy and Pharmaceutical Jurisprudence

B. Pharm., Fourth Year, Eighth Semester

Course Objectives:

The students will become familiar with the role of social pharmacy, pharmaceutical jurisprudence and regulatory requirements regarding social pharmacy in Nepal.

Course Contents:

- 1. Health and Disease** **6 hours**
Towards health for all, Role of WHO, Preventive medicine, Environment and health, Occupational health, Health information, Communication for health education, Health planning, International health
- 2. Pharmacy in Society** **12 hours**
Role of community pharmacy, Role of pharmacist, The contribution of pharmacy to today's health care provision, Social and behavioral aspects of pharmacy, Role of pharmacist in allopathic and traditional medicine treatments
- 3. Medical Jurisprudence** **6 hours**
Legal procedure in criminal courts, History of forensic medicine, Overview
- 4. Pharmaceutical Jurisprudence** **16 hours**
Ethics and professionalism, Pharmacy Acts, Drug regulations, National Drug Policy, Poisons and their regulations, Narcotics, Radiopharmaceuticals, WHO agreement, Consumer Act, Consequences of misuse
- 5. Regulatory Requirements for Social Pharmacy** **5 hours**
Acts, Space requirements, Regulations, Associations, Present situation in Nepal

Reference Books:

1. K. Park: *Park's Textbook of Preventive and Social Medicine* (16th Ed.) 2000, Banarsidas Bhanot Publishers, Jabalpur.
2. B. V. Subrahmanyam: *Modi's Medical Jurisprudence and Toxicology* (22nd Ed.) 1999, Butterworths, New Delhi.
3. Alfonso R. Gennaro: *Remington: The Science and Practice of Pharmacy*, Volume II (20th Ed.) 2002, Lippincott Williams & Wilkins, Philadelphia.
4. A. J. Winfield and R. M. E. Richards: *Pharmaceutical Practice* (2nd Ed.) 1998, Churchill Livingstone, Edinburgh.
5. Leon Shargel, Alan H. Mutnick, Paul F. Souney and Larry N. Swanson: *Comprehensive Pharmacy Review* (5th Ed.) 2004, Lippincott Williams & Wilkins, Philadelphia.

PHT 404 (Credit hours 3)

Pharmacoeconomics and Management

B. Pharm., Fourth Year, Eighth Semester

Course Objectives:

In this course the students will learn the principles of pharmacoeconomics and management principles related to drugs and pharmaceutical practice.

Course Contents:

1. Pharmaco-economics

8 hours

Fundamentals, Principles, Cost-calculations, break-even analysis and cost effectiveness analysis, Time value of money, Discounting and depreciation analysis, Financial analysis, Taxation and alternative health care financing (drug scheme) in Nepal

2. Management

10 hours

Fundamentals, Principles, Management and administration, Role of a manager, Functions of management, Production management, Entrepreneurship management, Managing small businesses, Role and impact of business in Nepalese economy

3. Community Pharmacy Economic and Management

6 hours

Economics of health care, Community pharmacy organization, Site selection, Capital, Management, Objectives and goals, Money, Inventory, Facilities, Personnel, Credit, Risk

4. Documenting and Billing for Pharmaceutical Care Services

6 hours

The role of documentation in pharmaceutical care, Narrative documentation, Standardizes documentation system, Limitations of standards, General payment principles, Records: legal, patient, financial

5. Product Recalls and Withdrawals

3 hours

Recall procedures, Background information on recalls, Consequences

6. Marketing Pharmaceutical Care Services

12 hours

Fundamentals of marketing, Marketing plan, SWOT analysis, Target markets and stakeholders, Marketing mix, Features versus benefits of the product or service, The marketing cycle, Promotion, advertising and sales management, Medical representatives, Customers services

Reference Books:

1. Alfonso R. Gennaro: *Remington: the Science and Practice of Pharmacy*, Volume II, 20th Edition, Lippincott Williams & Wilkins, Philadelphia, 2002.
2. Mickey Smith (Ed.): *Principles of Pharmaceutical Marketing* (3rd Ed.) 2002, CBS Publishers and Distributors, New Delhi.
3. Ashok K. Gupta: *Handbook of Drug Store and Business Management*, 2003, CBS Publishers and Distributors, New Delhi.
4. Leon Shargel, Alan H. Mutnick, Paul F. Souney and Larry N. Swanson: *Comprehensive Pharmacy Review* (5th Ed.) 2004, Lippincott Williams & Wilkins, Philadelphia.

PHT 405 (Credit hours 3)

Pharmacy Practice

B. Pharm., Fourth Year, Eighth Semester

Course Objectives:

The students will become familiar with the role of pharmacist in pharmacy practice, dispensing techniques and development of physician-patient-pharmacist relationship.

Course Contents:

- 1. Communication Skills for Pharmacist** **4 hours**
Meaning and types of communication, Assumptions and expectations in communication, Questioning and listening skills, Communicating with those with special needs, Non-verbal communication, Assertiveness, Transactional analysis, Barriers to communication
- 2. Prescription** **3 hours**
The structure and abbreviations used on a prescription, Generic prescribing, "Repeat" prescribing and dispensing, Procedures for checking the prescription, Record keeping, Preventing errors during dispensing
- 3. Basic Principles of Compounding and Dispensing** **12 hours**
Types of dosage forms, Weights, measures and units, Calculations for compounding and dispensing, Fundamental operations in compounding, GMP in compounding and dispensing, Formulation of dispensed products, Storage and stability of dispensed products, Containers and closures for dispensed products, Responding to the prescription, Labelling of dispensed medicines, Product recalls and withdrawals
- 4. Pharmaceutical Preparations** **6 hours**
Solutions, Suspensions, Emulsions and creams, Ointments, pastes and gels, Suppositories, Powders and granules, Oral unit dosage forms, Therapeutic aerosols, Wound management, stoma and incontinence patients, Medical gases
- 5. Sterile Pharmaceutical Preparations** **4 hours**
Aseptic technique, Design and operation of clean rooms, Parenteral products, Intravenous additives, Dispensing of cytotoxic agents, Total parenteral nutrition, Ophthalmic products, Principles of quality assurance, Sterility testing
- 6. Relating to the Patient** **6 hours**
Patient compliance and counseling, Patient medication records, Responding to symptoms, Diagnostic tests, Substance misuse, Addictions
- 7. Relating to the Prescriber** **6 hours**
Therapeutics in practice, Practical pharmacokinetics, Therapeutic drug monitoring, Adverse drug reactions, Drug information and pharmaceutical advice
- 8. Additional Information** **4 hours**
Medical abbreviations, Latin terms and abbreviations, Qualifications of practitioners, System of weights and measures, Sources of information for compounding and dispensing, Homeopathic medicine and traditional medicine preparations

Reference Books:

1. Dianne M. Collett and Michel E. Aulton: *Pharmaceutical Practice*, Churchill Livingstone, Edinburgh, 1996.
2. A. J. Winfield and R. M. E. Richards: *Pharmaceutical Practice*, 2nd Edition, Churchill Livingstone, Edinburgh, 1998.
3. Alfonso R. Gennaro: *Remington: the Science and Practice of Pharmacy*, Volume II, 20th Edition, Lippincott Williams & Wilkins, Philadelphia, 2002.
4. S. J. Carter (Ed.): *Cooper and Gunn's Dispensing for Pharmaceutical Students* (12th Ed.) 2000, CBS Publishers and Distributors, New Delhi.
5. Leon Shargel, Alan H. Mutnick, Paul F. Souney and Larry N. Swanson: *Comprehensive Pharmacy Review* (5th Ed.) 2004, Lippincott Williams & Wilkins, Philadelphia.

PRW 491 (Credit hours 6)

Project Work

B. Pharm., Fourth Year, Eighth Semester

Course Objectives:

The final project work will enable the students to search the relevant scientific literature, plan and perform original scientific work and write the thesis according to the world-recognized scientific standards. In the cases of successful projects of international relevance, the students will submit original research communications and articles to the recognized scientific journals.

IMPORTANT NOTICE TO STUDENT

Don't Miss!

- To attend daily lecture. If your attendance is less than 80%, you will not be allowed to sit in the final examination of University
- To secure more than 50% marks in average (D grade) of two internal assessments in a particular subject otherwise you will not be allowed to take part in the final examination of the University
- To secure D grade in final examination to pass the particular subject
- To secure SGPA 2.0 (C Grade) otherwise you will not enrolled to next semester.



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