

**SRI VENKATESWARA UNIVERSITY**  
**DEPARTMENT OF BIO-CHEMISTRY**  
**TIRUPATI – 517 502**

**ACADEMIC REGULATIONS**  
**COURSE STRUCTURE &**  
**DETAILED SYLLABUS**  
**(CBCS)**



**BACHELOR OF PHARMACY**  
**(B.PHARMACY)**

**CBCS-SEMESTER SYSTEM**  
**(w.e.f. 2016 – 2017)**

**SRI VENKATESWARA UNIVERSITY::TIRUPATI**  
**BACHELOR OF PHARMACY (B. PHARMACY)**

**REGULATIONS - 2016**

**Choice based credit system (CBCS): w.e.f. 2016-17.**

**INDEX:**

1. Admission, instruction and attendance
  2. Examinations: Sessional and Semester end examinations
  3. Practical training.
  4. Guidelines for paper setting and model papers.
- 
- 1.1 The degree of Bachelor of Pharmacy of Sri Venkateswara University will be conferred on candidates who have satisfied the following conditions.
  - 1.2 The candidate must have passed the Intermediate examination of the Board of Intermediate Education, Government of Andhra Pradesh, or Diploma in Pharmacy examination of the Dept. of Technical Education, Govt. of Andhra Pradesh or any other examination recognized by the academic senate as equivalent there to with Physics, Chemistry and Mathematics or Biology as group subjects and must have qualified in the Entrance Exams like EAMCET as prescribed by the University for being eligible to join I Year of B. Pharmacy course.
    - 1.3.1 The candidate must have, after passing the qualifying examination pursued a regular course of study for not less than four academic years (three academic years in the case of diploma in Pharmacy holders who are admitted directly in to 2<sup>nd</sup> year-Ist semester of B.Pharm) and satisfied the academic requirements as prescribed thereafter. The scope of subject matter in each course and periods of study shall be as indicated in the syllabus and the scheme of instruction.
    - 1.3.2 Instruction and examination in each academic year is spread over two semesters with a minimum of 90 working days in each semester (180 in any given academic year)
  - 1.4 Each period of instruction is of 45 minutes duration. Eight periods of instruction are provided on each day and there are six working days in a week (Monday to Saturday).
  - 1.5 Attendance Requirements: A regular course of study during an academic semester means a minimum of average attendance of 75% of all the courses of the semester computed by totaling the number of periods of lectures and practicals, as the case may be, held in every course. In special cases where sufficient causes were shown, the Vice-Chancellor may on the recommendation of the Principal and Head of the Department concerned condone the deficiency in the average attendance to an extent of 9% for reasons such as ill health, if the application for condonation is submitted at the time of actual illness and is supported by certificate of authorized Medical Officer approved by the Principal.

However, in the case of students, who participate in activities like N.S.S., N.C.C., Inter-Collegiate tournaments conducted by Sri Venkateswara University, Inter-University tournaments conducted by Inter-University Board and any such other activities involving the representation of the College/University with the prior approval of the principal, the candidate may be deemed to have attended the college during the period solely for the purpose of the examination.

- 1.6 A candidate who cannot satisfy the attendance requirements in clause 1.5 because of late admission under special circumstances reasonable and acceptable to the University on the basis of document, shall fulfill the following conditions; Average attendance: A candidate shall have attended at least a total of 90% of the periods-lectures/practicals as the case may be held from the date of admission and also shall attend at least 50% of the total working days during that academic semester (Late admission means, admissions made after 45 days from date of commencement of the academic semester for the course).
- 1.7 If any candidate fails to satisfy the regulation under 1.5 or 1.6 she/he shall not be allowed for the University Examinations at the end of the semester, and he/she shall not be allowed for promotion to the next higher class of study. He/she shall be required to repeat the regular course of study of that academic semester along with the next regular batch.
- 2.0 Assessment for the award of degree shall consists of (a) Internal evaluation for 20 marks in each of the theory courses separately except in course BPH 101 B. (b) Semester-end examination as detailed in the scheme of examination for 80 marks in each of the theory and practical, except for BPH 101 B and C Biology theory and practical.
- 2.1 Regulations concerning sessional examination: (a) There shall be two sessional examinations in each theory course and the average of the two shall be taken. The marks certificate issued to the candidate by the University shall show separately the sessional marks, the semester-end examination marks and the aggregate of both; (c) The teacher who teaches the subject shall ordinarily be the internal examiner, (d) There shall be no provision for the improvement of the sessional marks.  
Sessional Scripts shall be maintained in the Department until the results of the Semester are announced.
- 2.2 Regulations concerning semester-end examination: (a) there shall be one semester-end examination in each theory course based on the question paper set by an external paper setter and it shall be evaluated by an internal examiner. There shall be one semester-end examination in each practical course and the setting and evaluation shall be done jointly by two examiners, one internal and one external. The duration of the practical examination may be of 4 to 6 hours as prescribed. There shall be no supplementary examination except for the final semester-end examinations. A candidate shall not be allowed to appear for the IIIrd year II Semester end examination unless he passes in all the courses of the Ist year-end examinations and IInd Year-end examinations and shall also not be allowed to write the IVth Year IInd Semester-end examinations unless he passes in all the courses of the IIIrd year semester-end examinations.

- 3.1 A candidate shall be declared to have passed the examination in each semester if he obtains (i) not less than 40% marks in each theory and 40% in each practical of the semester-end examinations.
- 3.1a. A candidate may be permitted to improve his performance in semester-end examination of any semester only after completing the entire Four year course of study by appearing again for the whole examinations of that SEMESTER only during four subsequent years after completion of the study of the entire course. Such an improvement can be availed only once for each one of the semester examinations of the entire course of study. When considered in its totality the better of the two performances as whole at the Ist year(2semesters), IInd year(2semesters), IIIrd year(2semesters), IVth year (2semesters) as the case may be shall be taken into consideration for the purpose of awarding the grade.
- 3.1b. The courses BPH 101A (Mathematics), BPH 101B (Biology theory) and BPH 101C (Biology practical) are bridge courses for candidates with only biology and with only mathematics background respectively at the intermediate level. Candidates with Diploma in Pharmacy have to take course 101 Mathematics. The respective candidates shall have to pass in these courses. The marks awarded in these courses shall not be considered for calculation of SGPA and CGPA.
- 3.2 Any candidate who carried a backlog at any stage will not be eligible for rank, medal or prizes to be awarded by the University. First attempt means appearance at the first examinations conducted for the particular batch.
- 4.0 Every candidate shall undergo practical training for at least one month in pharmaceutical factory at the end of the final semester of the course.

#### **Grading system:**

Appropriate letter grades are awarded in each theory and practical subject to only such candidates who have passed in the university examinations. Internal assessment marks and university examination marks put together will be taken into account for the letter grading system in each subject separately.

A candidate registered for the university examination but fails to appear or fails to score the minimum required 40% marks in the university examination will get a grade 'F', indicating failure or grade of incompleteness.

A subject successfully completed cannot be repeated.

Final evaluation of each subject (theory and practical separately) will be carried out on a 10- point grading system corresponding to the marks obtained in that subject. Each subject letter grade is converted into a specific grade value associated with the letter grade as given below (Table).

**Table: 10-Point grading system:**

S.No.	Range of marks	Grade	Grade points
1.	$\geq 75\%$	O	10.0
2.	65% - 74.9%	A	9.0
3.	60% - 64.9%	B	8.0
4.	55% - 59.9%	C	7.0
5.	50% - 54.9%	D	6.0
6.	40% - 49.9%	E	5.0
7.	< 40%	F(Fail)	0.0
8.	The grade W represents failure due to insufficient attendance in the semester or year	W	0.0
9.	Incomplete (subsequently to be changed into pass or E or O or F grade in the same semester)	I	0.0

**Semester Grade point average (SGPA):**

The grade points are weighted in accordance with the number of credits assigned to a theory or practical subject and it is a product of credit and grade value. The semester grade point average (SGPA) is the weighted average of grade points awarded to a candidate.

$$\text{SGPA} = \frac{\text{Total grade points of a particular semester}}{\text{Total number of credits of the semester}}$$

Performance in the non credit courses in which a pass (i.e., 35% or more) is sufficient will not be considered for calculation of SGPA. SGPA (semester grade point average) for each semester will be calculated for those candidates who have passed all the subjects of that particular semester of the course. D.Pharm holders, who take direct admission to II B.Pharm, are exempted from First and second semester B.Pharm credits.

**Cumulative Grade Point Average (CGPA):**

The weighted average of SGPA's of all Semesters that the student has completed at any point of time is the cumulative grade point average (CGAP) at that point of time.

CGAP up to a semester will be calculated only for those students who have passed all the subjects up to that semester. Generally, CGPA is calculated after the successful completion of the entire B.Pharm course.

$$\text{CGPA} = \frac{\sum (\text{SGAP of each semester} * \text{corresponding number of credits})}{\text{Sum of the entire course credits}}$$

After the results are declared grade cards will be issued to each student, which will contain the list of subjects for that semester and grades obtained by the student.

For Diploma holders, who take direct admission to II B.Pharm, only six semester course credits i.e., 3rd to 8th semesters of B.Pharm will be considered for CGPA calculation.

- 4.1 In each Semester every student who satisfies the attendance requirements should register for examination, failing which he/she shall not be promoted to the next semester. Any such student who has not registered for examination in a semester shall repeat that semester in the next academic year after obtaining the proceedings of the Principal.
- 4.2 To pass a course in UG Programme, a student has to secure the minimum grade of (P) in the UG Semester end Examinations. A student obtaining Grade F shall be considered failed and will be required to reappear in the examination as supplementary candidate.
- 4.3 A student is eligible to improve the marks in a paper in which he has already passed, in with 4 years from the year of admission as and when it is conducted for the subsequent batches. This provision shall not be provided once the candidate is awarded Degree.
- 4.4 A student who has failed in a course can reappear for the End-Semester Examination as and when it is held in the normal course. The Sessional Marks obtained by the student will be carried over for declaring the result.
- 4.5 Whenever the syllabus is revised for a course, the semester a Examination shall be held in old syllabus three times. Thereafter, the students who failed in that course shall take the semester end Examination in the revised syllabus.

## **5. Guidelines for paper setting and model papers.**

### **5.1 Guidelines for paper setting:**

1. The semester end question paper in each theory course is to be set for a total of 80 marks by an external paper setter as per the general model given below.
- 2.1 The question paper in each theory course is to be divided into parts A and B.
- 2.2 Part A consists of 8 short answer questions each carrying 4 marks out of which 5 questions are to be answered by the candidate. Thus the total of part A is 20 marks.
- 2.3 Part B consists of 4 long answer questions with internal choice, each carrying 15 marks, All questions are to be answered by the candidate. Thus the total of part B is 60 marks.
- 2.4 The question given in parts A and B should be spread over the entire syllabus in an even manner.
- 2.5 The question paper in each semester end practical examination is to be set jointly by two examiners, one external and one internal as per the general model provided below.

### **1. Amendment to the Regulations:**

Sri Venkateswara University reserves the right to amend these regulations at any time in future without any notice. Further, the interpretation of any of the clauses of these regulations entirely rests with the University.

\*\*\*\*\*

### SCHEME OF INSTRUCTION AND EXAMINATION

Subject Code	Subject	Periods per week	Examination hours	Marks		Total Marks	No of Credits
				Sessional	Senester End		
I B.PHARM- I SEMESTER							
BPH 101A	Mathematics (For Bi.P.C. Stream)	3	3	20	80	100	4
BPH 101B	Biology (For M.P.C. Stream)	3	2	10	40	50	2
BPH 101C	Biology Practicals (For M.P.C. Stream)	2	2	–	50	50	2
BPH 102	English & Soft Skills	2	3	20	80	100	4
BPH 103	Pharmaceutical. Inorganic Chemistry	3	3	20	80	100	4
BPH 104	Pharmaceutical Organic Chemistry-I	3	3	20	80	100	4
BPH 105	Human Anatomy and Physiology	3	3	20	80	100	4
BPH 106	Pharmaceutical Inorganic Chemistry Practicals	4	3	–	100	100	2
BPH 107	Pharmaceutical Organic Chemistry-I Practicals	4	3	–	100	100	2
BPH 108	Human Anatomy and Physiology Practicals	4	3	–	100	100	2
I B.PHARM- II SEMESTER							
BPH 109	General & Dispensing Pharmacy	3	3	20	80	100	4
BPH 110	Pharmaceutical Organic Chemistry-II	3	3	20	80	100	4
BPH 111	Computer applications	2	3	20	80	100	4
BPH 112	Pharmacognosy I	3	3	20	80	100	4
BPH 113	Human Anatomy and Physiology and Pathophysiology	3	3	20	80	100	4
BPH 114	General & Dispensing Pharmacy Practicals	4	3	–	100	100	2
BPH 115	Pharmaceutical Organic Chemistry-II Practicals	4	3	–	100	100	2
BPH 116	Computer applications Practicals	2	3	–	100	100	2
BPH 117	Pharmacognosy I Practicals	4	3	–	100	100	2

<b>II B.PHARM- I SEMESTER</b>							
BPH 201	Physical Pharmacy –I	3	3	20	80	100	4
BPH 202	Pharmaceutical Engineering	3	3	20	80	100	4
BPH 203	Pharmaceutical Organic Chemistry – III	3	3	20	80	100	4
BPH 204	Pharmaceutical Biochemistry	3	3	20	80	100	4
BPH 205	Environmental Studies	3	3	20	80	100	4
BPH 206	Physical Pharmacy –I Practicals	4	3	–	100	100	2
BPH 207	Pharmaceutical Engineering Practicals	4	3	–	100	100	2
BPH 208	Pharmaceutical Organic Chemistry – III Practicals	4	3	–	100	100	2
BPH 209	Pharmaceutical Biochemistry Practicals	4	3	–	100	100	2
<b>II B.PHARM- II SEMESTER</b>							
BPH 210	Physical Pharmacy – II	3	3	20	80	100	4
BPH 211	Pharmaceutical Analysis – I	3	3	20	80	100	4
BPH 212	Pharmaceutical Technology – I	3	3	20	80	100	4
BPH 213	Pharmacognosy – II	3	3	20	80	100	4
BPH 214	Pharmacoinformatics & basics in drug discovery	3	3	20	80	100	4
BPH 215	Physical Pharmacy – II Practicals	4	3	–	100	100	2
BPH 216	Pharmaceutical Analysis – I Practicals	4	3	–	100	100	2
BPH 217	Pharmaceutical Technology–I Practicals	4	3	–	100	100	2
BPH 218	Pharmacognosy – II Practicals	4	3	–	100	100	2



III B.PHARM- I SEMESTER							
BPH 301	Pharmaceutical Technology-II	3	3	20	80	100	4
BPH 302	Medicinal Chemistry-I	3	3	20	80	100	4
BPH 303	Pharmacology-I	3	3	20	80	100	4
BPH 304	Pharmaceutical Microbiology	3	3	20	80	100	4
BPH 305	Drug store & Industrial. Managment.& Marketing	3	3	20	80	100	4
BPH 306	Pharmaceutical Technology-II Practicals	4	3	–	100	100	2
BPH 307	Medicinal Chemistry-I Practicals	4	3	–	100	100	2
BPH 308	Pharmaceutical Microbiology Practicals	4	3	–	100	100	2
III B.PHARM- II SEMESTER							
BPH 309	Medicinal Chemistry-II	3	3	20	80	100	4
BPH 310	Pharmacology-II	3	3	20	80	100	4
BPH 311	Pharmaceutical. Analysis II	3	3	20	80	100	4
Choice Based Credit Course							
BPH 312 A	Forensic Pharmacy	3	3	20	80	100	4
BPH 312 B	Clinical Trials						
BPH 312 C	Industrial.Pharmacy & cosmetic Technology						
BPH 313	Medicinal Chemistry-II Practicals	4	3	–	100	100	2
BPH 314	Pharmacology-II Practicals	4	3	–	100	100	2
BPH 315	Pharmaceutical. Analysis II Practicals	4	3	–	100	100	2

<b>IV B.PHARM- I SEMESTER</b>							
BPH 401	Medicinal Chemistry-III	3	3	20	80	100	4
BPH 402	Pharmacology-III	3	3	20	80	100	4
BPH 403	Pharmacognosy-III	3	3	20	80	100	4
BPH 404	Biopharmaceutics & Pharmacokinetics	3	3	20	80	100	4
<b>Choice Based Credit Course</b>							
BPH 405 A	Chemistry of Natural Products	3	3	20	80	100	4
BPH 405 B	Hospital&Community pharmacy						
BPH 405 C	Pharmacovigilance						
BPH 406	Medicinal Chemistry-III Practicals	4	3	–	100	100	2
BPH 407	Pharmacology-III Practicals	4	3	–	100	100	2
BPH 408	Pharmacognosy-III Practicals	4	3	–	100	100	2
BPH 409	Biopharmaceutics & Pharmacokinetics Practicals	4	3	–	100	100	2
<b>IV B.PHARM- II SEMESTER</b>							
BPH 410	Novel Drug Delivery Systems	3	3	20	80	100	4
BPH 411	Pharmaceutical Biotechnology	3	3	20	80	100	4
BPH 412	Clinical. Pharmacy & Therapeutics	3	3	20	80	100	4
BPH 413	Comprehensive Viva Voce			–	50	50	2
BPH 414	Project Work & Seminar		3	–	100	100	4

## SYLLABUS

**I B.PHARM- I SEMESTER****BPH 101A: MATHEMATICS (For Bi.P.C. Stream)****UNIT I: Algebra**

Arithmetic Progression-Geometric progression, quadratic equations: Equations reducible to quadratics, simultaneous equations (linear and quadratic). Logarithms: Logarithm of a real number to an arbitrary base, theorems on logarithms, application of logarithms in pharmaceutical computations and Partial fractions.

**UNIT II: Trigonometry**

Trigonometric ratios and the relations between them,  $\sin(A+B)$ ,  $\cos(A+B)$ ,  $\tan(A+B)$  formulae only, Trigonometric ratios of multiple and sub-multiple angles, Sum and Product transformations.

**UNIT-III: Co-ordinate Geometry**

Distance between points, Area of a triangle, Co-ordinates of a point dividing a given line segment in a given ratio, equation to a straight line in different forms, angle between straight lines-point of intersection.

**UNIT-IV: Differential and Integral calculus**

Limit of a function, differentiation, derivative, derivatives of trigonometric functions, logarithmic and partial differentiation, maxima and minima (elementary), derivatives of second order.

*Integration:* Definition of integration, integration by substitution, integration by parts and definite integrals. *Differential Equations:* Order and degree, formation of a differential, solution of first order differential equations (variable separable method) application of first order and first degree differential equation

**TEXT BOOKS:**

1. Intermediate first and second year mathematics text books printed and published by Telugu academy.
  2. A textbook of Remedial mathematics by P.Seshagiri Rao.
  3. Grewal B. S. Numerical Methods Khanna Publishers.
  4. Steve Dobbs & Jane, Miller Advanced Level Mathematics Statistics Cambridge University Press.
  5. Adams Dany Spencer Laboratory Mathematics Carrol & Graphs.
  6. Jenny Olive Maths. A Students Survival Guide Cambridge University Press.
- James R Barrante Applied Mathematics for Physical Chemistry (II ED.) Prentice Hall Incorporations

### **BPH 101B: BIOLOGY (For M.P.C. Stream)**

#### **UNIT I**

Plant and animal cell: Detailed structure. Structure, types and functions. Structure, types and functions of nucleic acids.. Mitosis, meiosis, different types of plant tissues and their functions.

#### **UNIT II**

Salient features and classification of plants into major groups-algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms. Classification of animal kingdom and salient features of each phyla.

#### **UNIT III:**

Simple and compound microscopes used in biology; section cutting; staining and mounting of sections. Morphology and histology of root, stem, bark, wood, leaf, flower, fruit and seed.

#### **UNIT IV**

Study of Structure and life history of parasites: Amoeba, Entamoeba, Trypanosoma, Plasmodium, Taenia, Ascaris, Schistosoma, Oxyuris and Ancylostoma.

General structure and life history of insects like Cockroach, Mosquito and Housefly.

#### **TEXT BOOKS**

1. Intermediate First Year and Second Year Botany / Zoology Text Books printed and published by Telugu Academy, Himayatnagar, Hyderabad.
2. A.C. Dutta, Text Book of Botany
3. Botany for Degree students Vol I & II by B.P. Pandey

#### **REFERENCES**

1. Concepts of biology, Enger.
2. Text book of Biology by S.B.Gokhale.
3. Outlines of zoology by M.Ekambaranatha Ayyar and T.N.Ananda Krishnan.
4. A manual for pharmaceutical biology practicals by S.B.Gokhale and C.K.Gokhale.
5. A text book of botany by Linda R. Berg.
6. Cell and molecular biology by Peter J. Russel, Stephen L. Wolfe, Paul E. Hertz.

**BPH 101C: BIOLOGY PRACTICALS (For M.P.C. Stream)****I. EXPERIMENTS:**

- a. Care and uses of microscope
- b. Gross identification of permanent slides plants/animals mentioned in the theory syllabus.
- c. Morphology of plant parts indicated in theory.
- d. Preparation, Microscopic Examination of stem, root and leaf of mono and dicot leaves.
- e. Structure of human parasites and insects mentioned in the theory with the help of specimen.

**II. Demo/Workshop:**

Dissection of cockroach mouth parts

**III. Seminar/Assignment/Group discussion:**

Preparation of Herbarium of plant parts indicated in theory and study of salient features for identification.

**REFERENCE:**

Intermediate Botany/Zoology Text manuals printed and published by Telugu academy, himayatnagar, Hyderabad.

## **BPH 102: ENGLISH & SOFT SKILLS**

### **UNIT-1**

Role and importance of communication, verbal and non verbal communication, group communication, effective communication, barriers to communication, communication media, participating in discussions, conduct of seminars, conferences etc., making presentations through collection, evaluation, organizing the information, interacting with learners and teachers, role of wit and humor in communication

### **UNIT-2**

Agreements and disagreements, how to use a dictionary,, synonyms and antonyms, one word substitutes, comprehension.

Communication through letters, official and personal letters, letters of complaint, letters of enquiries and responses, writing memos, circulars and notices, what to avoid while writing, paragraph writing.

### **UNIT-3**

Scientific/technical report writing, drafting and delivering a speech, resume writing and interview techniques

Grammar: sequence of tenses, voice, articles, direct and indirect speech, degrees of comparison , common errors in English made by Indian learners of English.

Concepts of learning and listening, types and methods of learning and listening, learning and listening of knowledge, attitudes, skills and practices.

### **UNIT-4**

**Effective Communication:** Elements of Communication, 7Cs of Communication, Types of Communication, Speaking and Listening, Non Verbal Communication, Writing Skills, Body Language, Improvement of Communication Skills.

**Effective Public Speaking:** Audience Analysis, Choosing the Subject, Preparation of Speech, Presentation, Use of various Aids, Launching Pad, Evaluation, How to overcome Stage fear.

**Team management:** identifying goals, setting targets, delegating tasks, monitoring and coordination.

**Interview facing:** preparation of the bio-data, preparation for the interview, attire, postures and gestures, right way of answering questions

#### **Textbooks:**

1. "business correspondence and report writing" R.C.sharma and Krishna mohan ,Tata Mc grawhill publishers, New Delhi
2. Communicative English, E.Suresh Kumar, RajKamal Publications, Hyd.
3. "Selections of Modern English Prose" Ed by Hladhar Panda, Published by Universities Press(India) Pvt Ltd, Hyd.
4. A hand book of English for professionals, 2<sup>nd</sup> edition by P.Eliah Published by Pharma book syndicate

## **BPH 103: PHARMACEUTICAL INORGANIC CHEMISTRY**

### **UNIT-1**

Brief introduction to I.P. and its contents, sources of impurities in pharmaceutical substances. Principles and procedure for the limit test of chlorides, sulphates, iron, lead and arsenic; test for purity (excluding assays) for the following compounds; aluminium hydroxide gel, barium sulphate, bismuth subcarbonate, calcium gluconate, ferrous sulphate, hydrogen peroxide, iodine, magnesium carbonate, potassium bromide, potassium permanganate and zinc oxide.

### **UNIT-2**

**Major intra and extracellular electrolytes:** requirements and functions of the following inorganic ions in the human body, sodium, potassium, calcium, chloride, iron, copper, magnesium and iodine. Physiological acid base balance, electrolytes used in acid-base therapy, acids and bases buffers and their pharmaceutical applications.

### **UNIT-3**

**Gastrointestinal agents:** Acidifying agents, antacids, protective and adsorbents and saline cathartics. Methods of preparation and uses of the following a) Acidifying agents; hydrochloric acid, sodium acid phosphate. b) Antacids: aluminium hydroxide, sodium carbonate, magnesium carbonate (light and heavy), milk of magnesia, magnesium trisilicate and magnesium oxide c) Protective and adsorbents: boric acid, zinc oxide, calamine, kaolin, charcoal d) Saline cathartics: sodium potassium tartarate, magnesium sulphate, sodium phosphate.

**Topical agents:** Protectives, astringents, antifungal, anti protozoal and antiseptics. Ammoniated mercury, borax, hydrogen peroxide, iodine, yellow mercuric oxide, potassium permanganate, silver nitrate, silver protein, sulphur, sodium perborate, alum, bismuth subcarbonate, bismuth subgallate, zinc oxide, zinc sulphate.

### **UNIT-4**

**Gases and respiratory stimulants:** oxygen, carbon dioxide, helium, nitrogen, nitrous oxide; non essential and essential trace ions; dental products, anticaries agents, dentifrices; inorganic radiopharmaceuticals and their pharmaceutical applications. Inorganic radioopaque substances. Preparation and uses of the following reagents a) lithium aluminium hydride b) anhydrous aluminium chloride c) perchloric acid d) boron trifluoride e) ceric ammonium sulphate. Miscellaneous inorganic pharmaceutical agents: a) expectorants and emetics b) haematinics c) poisons and antidotes d) sedatives e) complexing and chelating agents. Principles and procedures involved in identification of simple salts.

#### **Text books:**

1. Practical pharmaceutical chemistry by A.H. Beckett and J.B. Stenlake
2. Indian pharmacopoeia
3. Text book of pharmaceutical chemistry by Bentley and Driver
4. Inorganic pharmaceutical chemistry by Rogers  
Inorganic pharmaceutical and medicinal chemistry by Block, Roche, Soine and Wilson.

## **BPH 104: PHARMACEUTICAL ORGANIC CHEMISTRY-I**

### **UNIT-1**

Structure and properties of organic molecules: Atomic and molecular orbitals. Bond formation in organic compounds, hybridization, polarity of bonds and molecules, intra and inter molecular forces, influence of structure on physical properties, modern theories of acids and bases, homolysis and heterolysis, types of reagents and reactions, inductive and mesomeric effects; Nomenclature, concepts of isomerism.

### **UNIT-2**

**Alkanes:** Nomenclature, general methods of preparation, energy of activation, transition state, reactions of alkanes with special reference to substitution, free radicals chain reactions, stability of free radicals, bond dissociation energy, free rotation about carbon-carbon single bonds and conformational isomerism, study of composition and uses of liquid paraffin, soft paraffin, white soft paraffin, hard paraffin and ichthammol.

**Stereo chemistry:** Optical isomerism, chirality, configuration, specification of R and S configuration, sequence rules, diastereomers, meso structures, stereoisomerism, Cyclo alkanes: Nomenclature, preparation, Bayer's strain theory, chair and boat conformations of cyclohexane, axial and equatorial bonds.

**Halo alkanes:** Nomenclature, general methods of preparation nucleophilic substitution,  $S_N1$  and  $S_N2$  mechanisms,  $E1$  and  $E2$  mechanisms for eliminations, preparation and uses of ethyl chloride, chloroform and iodoform.

### **UNIT-3**

**Alkenes:** Nomenclature, two important methods of preparation, structure of ethylene, carbonium ion theory electrophilic and free radical addition to carbon-carbon double bonds, Markovnikov's rule, peroxide effect, ozonolysis, introduction to alkadienes, stability of conjugated dienes, theory of resonance and hyperconjugation.

**Alkynes:** Nomenclature, acidity and general methods of preparation, structure of acetylene, reactions of alkynes (Formation of metal acetylides, stereo specific reduction of alkynes, addition reactions of alkynes).

### **UNIT-4**

**Organometallic compounds:** preparation and synthetic applications of Grignard reagents.

**Alcohols:** Nomenclature, industrial sources, general method of preparation and reactions, study of ethyl alcohol, rectified spirit, industrial spirit, proof spirit, absolute alcohol, benzyl alcohol, cinnamyl alcohol, propylene glycol and glycerol.

**Ethers:** Nomenclature, general methods of preparation and reactions (Williamson's-synthesis and action of HI), preparation and uses of diethyl ether.

#### **TEXT BOOKS**

1. Advanced pharmaceutical organic chemistry, Bahl & Bahl, S.Chand
2. Organic chemistry, T.R.Morrison and R.N.Boyd, Pearson Education India, New Delhi.

#### **REFERENCES**

1. Organic chemistry, Bruice 6<sup>th</sup> Edition, Pearson Publisher, 2010.
2. Reactions and Mechanism, Jerry March, 4<sup>th</sup> edition Wiley Publication.
3. Organic chemistry, Carey, 8<sup>th</sup> Edition, Mc Graw-Hill.
4. Organic chemistry, Pillai Orient Longman Publisher.
5. The Fundamentals Principles of Organic Chemistry Vol.I & Vol. II, I.L.Finar, ELBS/Longman



## **BPH 105: HUMAN ANATOMY AND PHYSIOLOGY**

### **UNIT I:**

Cell, tissues and musculoskeletal system

- a. Scope of anatomy and physiology, basic terminology used in these subjects. Structure of cell, its components and their functions. Body fluids, biological molecules and homeostasis.
- b. Elementary tissues of the human body: epithelial, connective, muscular and nervous tissues, their sub- types and characteristics.
- c. Haemopoietic system: Composition and functions of blood and its elements, blood groups and their significance and mechanism of blood coagulation

### **UNIT II:**

Cardiovascular system

Basic anatomy of the heart. Physiology of heart, blood vessels and circulation. Basic pulmonary, coronary and hepatic system. Understanding of cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation.

Lymph and Lymphatic System: Composition, formation and circulation of lymph; Basic physiology and functions of spleen.

### **UNIT III:**

Skeletal System

Structure, composition and functions of skeleton. Joints, classification of joints, types of movements of synovial joints.

Gross anatomy, physiology of muscle contraction and physiological properties of skeletal muscles.

### **UNIT IV:**

Digestive System:

Gross anatomy of the gastro-intestinal tract, functions of its different parts including those of liver, pancreas and gall bladder, various gastrointestinal secretions and their role in the absorption and digestion of food. *Respiratory System:* Gross anatomy of respiratory tract, Functions of its different parts, functions, mechanism and regulation of respiration, respiratory volumes and vital capacity.

### **TEXT BOOKS:**

1. Principles of Anatomy and Physiology, Tortora, G.J and Anagnostakos, N.P Harper & Row Publishers N.Y.
2. Text Book of Human Anatomy, Ross & Willson, M.J. Mycek S.B Gerther and MMPER.
3. Human Physiology, C.C.Chatterjee. Rosen Educational Publishing 13<sup>th</sup> Edition.
4. Textbook of Medical Physiology, Guyton, AC Guyton WB Saunders Company, 1995. 12<sup>th</sup> Edition Saunders – Elsevier.

### **REFERENCES:**

1. Essential of Human Anatomy & Physiology, Elaine N. Marieb 6<sup>th</sup> Edition Benjamin Cummings.
2. Fundamentals of Anatomy & Physiology, Rizzo, Cengage learning (2009) 3<sup>rd</sup> Edition.
3. Human Anatomy, Mc Kinley, Mc Graw Hill 2009.

## **BPH 106: PHARMACEUTICAL INORGANIC CHEMISTRY PRACTICALS**

### **I. Experiments:**

#### **A) Limit tests for the following as per the procedure given in Indian Pharmacopoeia (1996 – including the latest addenda)**

- 1) Chlorides
- 2) Sulphates
- 3) Heavy metals
- 4) Iron
- 5) Arsenic
- 6) Modifications in limit test for chlorides and sulphates in potassium permanganate, sodium bicarbonates, sodium benzoates and sodium salicylates.

#### **B)**

- 7) **Balances and Weighing; Calibration of weights, Pipette and Burette.**
- 8) Preparation and standardization of **Hydrochloric acid** solution (0.1N).
- 9) Preparation and standardization of **Potassium permanganate** solution (0.1N & 0.1M).
- 10) Preparation of a primary standard solution of 0.1N **Potassium hydrogen-phthalate.**
- 12) Preparation and standardization of 0.1N **EDTA** solution.
- 12) Preparation and purification of **Boric acid.**
- 13) Preparation and purification of **Sodium citrate.**
- 14) Preparation and purification of **Potash alum.**
- 15) Preparation and purification of **Magnesium stearate.**
- 16) Assay of sodium bicarbonate and assay of **Boric acid** (Neutralization).
- 17) Assay of Calcium gluconate (or) any calcium compounds (Complexometry).
- 18) Assay of Copper sulphate (Redox titration).
- 19) Assay of Sodium acetate (Non-aqueous titration).
- 20) Assay of Ferrous sulphate (Oxidation-reduction / Redox titration).
- 21) Swelling power of **bentonite**
- 22) Test for purity (Ammonium salts in potash alum, presence of iodates in KI)

### **II. Demo/workshop**

Labelling, handling, storage of inorganic compounds, safety practices in laboratory, identification of anions and cations.

### **III. Assignment/Seminar/Group Discussion**

1. Radioactive metals in the environment and its importance
2. Importance of inorganic compounds in cancer
3. Different catalysts which are used in various organic preparations and their characteristics
4. Inorganic metals used in biochemical functions and their role.

### **REFERENCES**

1. Practical pharmaceutical chemistry, Part-I, A.H.Beckett and J.B.Stenlake, The Athlone press, University of London, London.
2. Inorganic chemistry, Gary L.Miessler and Donald A.Tarr, 3/e, Pearson education, New Delhi
3. Inorganic pharmaceutical chemistry, P. Gundu Rao, Vallabh Prakashan, Delhi.
4. Advanced Inorganic Chemistry, G.D.Tuli, Satya prakash, S.Chand 2006.
5. Modern inorganic chemistry by William L. Jolly Mc Graw-Hill, New York 1984
6. Indian Pharmacopoeia 1996, 2007.

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Analytical balances
  2. Physical balances
  3. Suction pumps
  4. Oven
  5. Hot plates
  6. Water baths
  7. Distillation unit
- Limit test apparatus for arsenic

## **BPH 107: PHARMACEUTICAL ORGANIC CHEMISTRY-I PRACTICALS**

### **I. Experiments:**

- A. Introduction to Equipment & Glassware, Recrystallization method, details of M.P, B.P and distillation
- B. Determination of physical constants like melting point and boiling point.
- C. Identification of the following organic compounds by systematic qualitative analysis including acidic/basic/neutral character, aromatic/aliphatic, saturated/unsaturated, test for special elements and functional group identification tests.
  - a. Phenols
  - b. Amides
  - c. Amines
  - d. Carboxylic acids
  - e. Aldehydes and Ketones
  - f. Alcohols
  - g. Anilides and nitrocompounds
  - h. Esters

### **II. Demo / work shop**

Crystallization by using various solvents, Melting point for different crystals of same compound, Laboratory safety exercises, Atomic models emphasizing hybridization/organic molecules

### **III. Seminar/assignment/group discussion**

Exercise on nomenclature of compounds, Knowledge on CAS, IUPAC, ACS, material safety data and different types of explosive, oxidizable substances.

## **REFERENCES**

1. Text Book of Practical Organic Chemistry, Vogel's, 5<sup>th</sup> Edition Pearson.
2. Laboratory Manual of Organic Chemistry, R.K. Bansal, New Age International 5<sup>th</sup> Edition 2007.
3. Advanced Practical Organic Chemistry, O.P. Agarwal, 3<sup>rd</sup> Edition Goel Publication.
4. Practical Organic Chemistry, F.G.Mann & B.C. Saunders, Pearson 4<sup>th</sup> Edition.

## **LIST OF MINIMUM EQUIPMENT REQUIRED**

1. Triple beam balances
  2. Physical balances
  3. Melting point apparatus
  4. Suction pumps
  5. Oven
  6. Hot plates
  7. Water baths
  8. Distillation unit
  9. Refrigerator
- Adequate glassware

## **BPH 108: HUMAN ANATOMY AND PHYSIOLOGY PRACTICALS**

### **I. EXPERIMENTS:**

1. Study of compound microscope
2. Microscopic study of different tissues
3. Study of human skeleton
4. Estimation of Haemoglobin in blood
5. Determination of bleeding time
6. Determination of clotting time
7. Study of neubar's chamber
8. Estimation of R.B.C. count
9. Estimation of W.B.C count
10. Estimation of D.L.C.
11. Recording of body temperature
12. Recording of pulse rate and blood pressure.
13. Experiments on spirometry -- Determination of vital capacity etc.,
14. Study of different family planning appliances

### **II. DEMO/ WORK SHOP**

1. Study of different systems with the help of charts and models.
2. Study of ECG - basic understanding of electrocardiogram-PQRST waves and their significance

### **III. SEMINAR/ ASSIGNMENT/ GROUP DISCUSSION**

1. Lysosomal storage disorders
2. Vaccination and vaccination schedule

### **REFERENCES**

1. Practical human anatomy and physiology, S.R.Kale & R.R.Kale, latest edition.
2. Practical Biochemistry, Plummer.
3. Human Anatomy & Physiology, Elaine N. Marieb.
4. Human Physiology, A.K. Charterjee.

### **LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Microscopes
2. Glass slides
3. Hemocytometer with micropipettes
4. Sahli's hemoglobinometer
5. Hutchinson's spirometer
6. Sphygmomanometer
7. Stethoscope
8. Permanent slides for various tissues
9. Models for various organs and system
10. Specimen of various organ and system
11. Skeleton and bones
12. Clinical thermometers
13. ECG graphs.
14. Stop clocks
15. Different contraceptive devices and models.

## **I B.PHARM- II SEMESTER**

### **BPH 109: GENERAL & DISPENSING PHARMACY**

#### **UNIT I Origin and History**

Development of pharmacy, Evolution of Pharmacy education & Pharma industry in India. Origin and development of the Pharmacopoeias, History of Ayurveda, salient features of IP, USP and BP.

#### **UNIT II Dispensing Pharmacy**

Drug - Definition, Essential characteristics. Dosage form – Definition, Classification, Formulation and purpose. Principles of dispensing, parts of prescription, handling of prescription, general dispensing procedures, source of errors in prescription and care required in dispensing procedures including labeling of dispensed products.

#### **UNIT III Pharmaceutical calculations**

Weights and Measures, introduction to Latin terms, Percentage calculations, alligation method, proof spirit calculations, displacement value and calculations of isotonicity adjustment. Posology-factors affecting selection of dose & dosage form and calculations of doses.

#### **UNIT IV Principles involved and procedures adopted in dispensing of the following classes of preparations:**

i) Powders ii) Solutions iii) Mixtures iv) Lotions & liniments v) Suspensions vi) Emulsions and vii) Ointments.

Incompatibilities: Introduction, classifications, methods to overcome incompatibility.

#### **TEXT BOOKS**

1 Dispensing Pharmacy, Cooper & Gunns CBS, Publ. and Distributors New Delhi – (2008).

2 Dispensing Pharmacy, R.M Metha, 2006 Vallabh Publication, New Delhi.

#### **REFERENCES**

1. Text Book of Pharmaceutics, E.A. Rawlins, Bentley's ELBS publ.

2. Essential dosage calculations -Hospital Pharmacy. Lorria & William, William Hassan.

## **BPH 110: PHARMACEUTICAL ORGANIC CHEMISTRY-II**

### **UNIT - I:**

**Alcohols:** Nomenclature, classification, general methods of preparation, physical properties, hydrogen bonding, characteristic nucleophilic substitution reactions (replacement of -OH by -Cl), elimination reactions, and relative reactivities of 1°, 2° and 3° alcohols, Meerwein Ponderff Verley reduction.

**Phenols:** Nomenclature, general methods of preparation, physical properties, acidity of phenols, stability of phenoxide ion, reactions of phenols, Kolbe-Schmidt reaction, Fries rearrangement, and Reimer-Tiemann Reaction.

**Ethers:** Nomenclature, Williamson's synthesis, action of hydroiodic acid on ethers (Ziesel's method).

### **UNIT - II:**

#### **Aromatic Hydrocarbons:**

Kekule Structure of Benzene, Bond Length, Heat Of Hydrogenation, Stability, Molecular Orbital Picture Of Benzene, Aromaticity, Huckel's rule, Nomenclature of benzene derivatives, Characteristic reactions of Benzene, Theory of reactivity and orientation in Monosubstituted Benzenes

#### **Aromatic Halogen Compounds:**

Nomenclature, Low reactivity of Halobenzenes towards nucleophilic substitution, Arenes, Benzyne ion Concept.

### **UNIT-III:**

#### **Polynuclear Aromatic Hydrocarbons**

Nomenclature, Structure and Aromatic Character of Naphthalene, Anthracene and Phenanthrene resonance structures, electron density and reactivity, electrophilic substitution, oxidation and reduction reactions.

### **UNIT - IV:**

**Carboxylic acids:** Nomenclature, intermolecular association, stability of carboxylate anion, two important methods of preparation, decarboxylation, functional groups reactions and reduction of carboxylic acids.

**Acid derivatives:** (acid chlorides, anhydrides, esters and amides): Nomenclature, reactions like hydrolysis, reduction of esters and amides, Hofmann's degradation of amides. Brief account of preparation and properties of malonic and acetoacetic esters, their importance in organic synthesis.

**Nitro compounds:** Nomenclature, acidity of nitro compounds containing  $\alpha$ -hydrogens, reductive reactions of aromatic nitro compounds.

**Amines:** Nomenclature, classification, basicity of amines, relative reactivity, Hinsberg method of separation, acylation reactions. Diazotisation and reactions of diazonium salts.

### **TEXT BOOKS**

- 1 Advanced pharmaceutical organic chemistry, Bahl & Bahl, S.Chand.
1. Organic chemistry, T.R.Morrison and R.N.Boyd, Pearson Education India, New Delhi.

### **REFERENCES**

- 1 Organic chemistry, Bruice 6<sup>th</sup> Edition, Pearson Publisher, 2010.
- 2 Reactions and Mechanism, Jerry March, 4<sup>th</sup> edition Wiley Publication.
- 3 Organic chemistry, Carey, 8<sup>th</sup> Edition, Mc Graw-Hill.
- 4 Organic chemistry, Pillai Orient Longman Publisher.
- 5 The Fundamentals Principles of Organic Chemistry Vol.I & Vol. II, I.L.Finar, ELBS/Longman.

**BPH 111: COMPUTER APPLICATIONS****UNIT-1**

Introduction to computers-their development through generations-classification-applications of computers. Anatomy of computers; keyboard, monitor and CPU-input devices like **OCR;OMR,MICR**- output devices like printers, types of computer memory, storage devices-floppy disk, hard disk drives and magnetic tapes.

Software-types of software-machine language-binary code-bits and –bytes-ASCII codes, high level languages, languages processors- compilers, interpreters, problem solving, algorithms and flow charts.

**UNIT-2**

BASIC-character set-features of BASIC program-statements, keywords-writing and editing a program-execution, saving and loading Constants and variables, expressions-use of statements like LET, INPUT, READ DATA, RESTORE, REM, PRINT, END-printer controls-control statements GOTO,ON GOTO,IF THEN, IF –THEN-ELSE, FOR NEXT, GOSUB-graphics in basic

**UNIT-3**

Operating systems-MSDOS-various internal commands-DIR and its keys, MD, RD, CD,COPY CON, COPY, REN, DEL, TREE, DEL TREE, FORMAT.

Windows- important features, various accessories-windows explorer, locating and copying files.

MS-OFFICE: MS-WORD-editing documents, formatting text and various features.

MS- EXCEL- organization of work sheet, editing cells, generating graphs.

**UNIT-4**

ORACLE-introduction to managing data-data base concepts-RDBMS characteristics.

Interactive SQL-the oracle data types- two dimensional matrix creation, creating tables, data entry, editing data, updating-computation-logical operations, manipulating data-oracle functions-indexes



## **BPH 112: PHARMACOGNOSY I**

### **UNIT I**

- A) Definition, history, development and scope of Pharmacognosy
- B) Brief introduction to natural sources of drugs with examples: plants, animals, minerals, marine and microorganisms

### **UNIT II**

- A) Classification of drugs of natural origin: Alphabetical, morphological, taxonomical, chemotaxonomic, pharmacological and chemical classification with suitable examples.
- B) Cultivation, collection, processing, drying, and storage of medicinal plants.
  - Factors influencing cultivation of medicinal plants.
  - Plant hormones and their applications.
  - Improved methods of cultivation techniques: polyploidy, mutation and hybridization with reference to medicinal plants.
  - WHO guidelines on Good Agricultural and Collection Practices (GACP) for medicinal plants

### **UNIT III**

- A) Introduction, definition, classification, different chemical tests for the carbohydrates and derived products. Systemic Pharmacognostic study of the following carbohydrates and derived products: Acacia, Tragacanth, Agar, Starch, Guar gum, Pectin, Isabgol and Honey.
- B) Definition, classification and properties of tannins. Study of tannin containing drugs-Gambir, Black catechu, Galls, Myrobalan and Arjuna.

### **UNIT IV**

- A) Study of source, preparation and identification of fibres used in pharmacy like cotton, silk, wool, nylon and polyester.
- B) Introduction, definition, classification, different physical, chemical properties, extraction methods, chemical tests for the lipids. Systemic Pharmacognostic study of the following lipids: castor oil, cod liver oil, shark liver oil, linseed oil, cocoa butter, kokum butter, bees wax, wool fat, hydnocarpus oil, Rice bran oil and Lard.

### **TEXT BOOKS:**

1. Kokate C.K., Purohit A.P., Gokhale S. B. Pharmacognosy, Nirali Prakashan, New Delhi.
2. Text book of Pharmacognosy by Handa and Kapoor.
3. Pharmacognosy by Robert, Tyler.

### **REFERENCE BOOKS:**

1. WHO guidelines on good agricultural and collection practices (GACP)-WHO, Geneva
2. Cultivation & utilization of medicinal plants by Atal CR and Kapoor BM.
3. Text book of Pharmacognosy by Wallis.
4. Pharmacognosy by Trease and Evans, latest edition.  
Swain T; Chemical Plant taxonomy, Academic Press London

## **BPH 113: HUMAN ANATOMY AND PHYSIOLOGY AND PATHOPHYSIOLOGY**

### **UNIT I**

**a. Central Nervous System:** Functions of different parts of brain and spinal cord. Structure of blood brain barrier and its importance. Neurochemical transmission in the central nervous system, reflex action, electroencephalogram, Specialized functions of the brain, cranial nerves and their functions.

**b. Autonomic Nervous System:** Physiology and functions of autonomic nervous system. Mechanism of neurohumoral transmission in the A.N.S.

### **UNIT II**

**a. Urinary System:** Various parts, structures and functions of the kidney and urinary tract. Physiology of urine formation and acid base balance.

**b. Reproductive Systems:** Male and Female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis & oogenesis, pregnancy its maintenance and parturition.

### **UNIT III**

**a. Endocrine System:** Basic anatomy and physiology of pituitary, thyroid, parathyroid, adrenals, pancreas, testes and ovary, their hormones and functions.

**b. Study of sense organs:** Structure of eye, ear, nose, skin and tongue along with their detailed functioning.

### **UNIT IV**

**a. Basic Principles of Cell Injury, Adaptation & process of inflammation:** Causes of cellular injury, pathogenesis, and morphology of cell injury. Cellular adaptations, atrophy, hypertrophy. acute and chronic inflammation, mediators of inflammation, brief outline of the process of repair.

**b. Cancer:** Classification of tumours, difference between benign and malignant tumours, disturbances of growth of cells, etiology and pathogenesis of cancer, invasions, metastasis and patterns of spread of cancer and histological diagnosis of malignancy.

- c. Pathophysiology of common diseases** like epilepsy, psychosis, depression, mania, hypertension, angina, congestive cardiac failure, atherosclerosis, myocardial infarction, rheumatoid arthritis, gout, peptic ulcer, asthma, hepatic disorders, T.B, UTIs and STDs.

### **TEXT BOOKS:**

1. Harsh mohan, text book of pathology, latest edition.
2. Sherword- Principles of Human Physiology. Cenage learning.
3. Ross & Willson, Principles of anatomy and physiology, John wiley & Sons
4. C.C.Chatterjee, Human Physiology, Pub by Medical allied agency, Delhi, India.
5. M.P. Rang, M.N.Dale, J.M Riter Anotomy & Physiology.

### **REFERENCE BOOKS:**

1. Robbins, SL & Kumar, Basic Pathology. 8<sup>th</sup> Edition Elsewier.
2. Mary V. Buras, Pathophysiology: A self Instructional programme. Prentice Hall.
3. Mary Lou Mulvihill, Human Diseases: A Systemic approach. Prentice Hall 6<sup>th</sup> Edition.
4. A.C Guyton, Textbook of medicinal physiology by by W.B.Prism books Pvt. Ltd., Delhi.
5. Joseph Dipiro, Pathophysiology and applied therapeutics

## **BPH 114: GENERAL & DISPENSING PHARMACY PRACTICALS**

### **I. EXPERIMENTS**

- a) Dispensing of prescriptions falling under the categories: Mixtures, syrups, solutions, emulsions, ointments, powders, lotions, liniments (minimum two prescriptions from each class).
- b) Identification of physical, chemical and therapeutic incompatibilities in a prescription, and dispensing of such prescriptions (3 Exercise).
- c) Dispensing procedures involving pharmaceutical calculations, and dosage calculations for paediatric and geriatric patients

### **II. DEMO/WORKSHOP**

Demo on homogenizer and identification test for emulsions.

### **III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

- a) Current status of Indian pharma industry.
- b) Applications of various dosage forms.

### **REFERENCE:**

- a) Dispensing Pharmacy, Cooper & Gunns CBS, Publ. and Distributors New Delhi – (2008).
- b) Dispensing Pharmacy, R.M Metha, 2006 Vallabh Publication, New Delhi.

### **LIST OF MINIMUM EQUIPMENT REQUIRED**

Adequate number of the following, such that each student gets

1. Mortars and pestles.
2. Analytical balance and weight box.
3. Percolators.
4. Dispensing containers.
5. PH meter.
6. Electronic balance.
7. Adequate quantities of chemicals and glassware.

## **BPH 115: PHARMACEUTICAL ORGANIC CHEMISTRY-II PRACTICALS**

### **I. Experiments:**

- A. Preparation of organic compounds (each involving a specific organic reaction covered in theory- any 10 synthesis)
  1. Sulphonation : Preparation of Toluene para sulphonic acid from toluene.
  2. Bromination : Tribromoaniline from Phenol or Aniline.
  3. Addition/Elimination : Preparation of phenyl hydrazone or oxime from Benzaldehyde.
  4. Addition : Preparation of 2,3-dibromo-3-phenyl propionic acid from cinnamaldehyde.
  5. Dehydration : Preparation of acetonedicarboxylic acid from citric acid
  6. Condensation : Preparation of dibenzalacetone from benzaldehyde
- B. Identification of the following organic compounds by systematic qualitative analysis including acidic/basic/neutral character, aromatic/aliphatic, saturated/unsaturated, test for special elements and functional group identification tests.

- a. Phenols
- b. Amides
- c. Amines
- d. Carboxylic acids
- e. Aldehydes and Ketones
- f. Alcohols
- g. Anilides and nitrocompounds
- h. Esters

## **II. Demo / work shop**

Crystallization by using various solvents, atomic models emphasizing organic molecules & TLC for synthesized compounds.

## **III. Seminar/assignment/group discussion**

Exercise on nomenclature of compounds, Knowledge on Protection of groups by green chemical methods, microwave assisted synthesis.

## **REFERENCES**

1. Text Book of Practical Organic Chemistry, Vogel's, 5<sup>th</sup> Edition Pearson.
2. Laboratory Manual of Organic Chemistry, R.K. Bansal, New Age International 5<sup>th</sup> Edition 2007.
3. Advanced Practical Organic Chemistry, O.P. Agarwal, 3<sup>rd</sup> Edition Goel Publication.
4. Practical Organic Chemistry, F.G.Mann & B.C. Saunders, Pearson 4<sup>th</sup> Edition.

## **LIST OF MINIMUM EQUIPMENT REQUIRED**

1. Triple beam balances
2. Physical balances
3. Melting point apparatus
4. Suction pumps
5. Oven
6. Hot plates
7. Water baths
8. Distillation unit
9. Refrigerator
10. Adequate glassware

### **BPH 116: COMPUTER APPLICATIONS PRACTICALS**

1. use of MS-DOS commands like DATE, TIME, DIR, COPY CON, MD, CD, RD, COPY, DEL, FORMAT, PATH etc.,
2. writing of at least ten programs in basic using various statements like REM, LET, PRINT, END, INPUT, READ-DATA, GO TO, IF THEN, FOR-NEXT, PSET, LINE, CIRCLE, COLOUR etc.,
3. At least five exercises each in MS-WORD and MS-EXCEL using various features available/preparation of documents- editing-tabulation of data-generation of charts.
4. at least five exercises in data base management using ORACLE- interactive SQL-creating tables, editing, computation etc.,

#### **RECOMMENDED BOOKS:**

1. basic computer programming- V.K Jain, pusthak mahal, Delhi
2. programming in basic by E.Balagurusami,tatamcgrawhill
3. programming in basic-Gottfried,tata mcgrawhill
4. abc of windows 98-BPB Publications ,New Delhi
5. working in microsoft office-Ronmansfield
6. commercial application development using ORACLE developer 2000 by Iran bay ross,BPB Publications, New Delhi
7. Computer fundamentals with pharmacy applications by N.K.Tiwari published by pharma book syndicate.

### **BPH 117: PHARMACOGNOSY I PRACTICALS**

#### **EXPERIMENTS:**

1. Collection and preparation of herbarium/laminated photos/ specimens of natural drugs.
2. Study of microscope.
3. Study of various morphological characters of the drugs mentioned in theory under carbohydrates.
4. Study of various morphological characters of the drugs mentioned in theory under lipids.
5. Study of various morphological characters of the drugs mentioned in theory under tannins.
6. Study of various morphological characters of the drugs mentioned in theory under fibres.
7. Chemical tests for Acacia, Tragacanth, Guar gum, Agar and Starch.
8. Chemical tests for Castor oil, Linseed oil, Shark liver oil, Cod liver oil.
9. Chemical tests for Gambir, Black catechu.
10. Chemical test for fibres mentioned in theory.
11. Determination of swelling factor of mucilage containing herbal drug.

#### **Seminar/ Assignment:**

Seminar/ Assignment related to theory:

#### **Workshop/Demo**

Cultivation of medicinal plants

**References**

1. Practical Pharmacognosy, C K Kokate, Nirali Prakashan
2. Practical Pharmacognosy, Khandelwal, Nirali Prakashan
3. Practical Pharmacognosy Iyengar, Manipal Press Ltd.
4. Brain KR and Turner TD. The practical Evaluation of Phytopharmaceuticals, Wright-Scientechics, Bristol.
5. Peach K and Tracey MV, Modern methods of Plant analysis, Narose publishing house, New Delhi.

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Microscopes with stage
  2. Heating mantle
  3. Water baths
- Adequate glass wares

## **II B.PHARM- I SEMESTER**

### **BPH 201: PHYSICAL PHARMACY –I**

#### **UNIT I**

**Intermolecular forces and states of matter:** Binding forces between molecules, the states of matter, change in the state of matter, latent heat and vapour pressure, sublimation critical point, eutectic mixtures, relative humidity, the liquid state, liquid crystalline state, Glossy state and solid state, amorphous and polymorphism.

**Phase rule:** Definition and explanation. One component (water system), two compartment system (phenol - water system & TEA (Tri Ethyl Amine) and Water system).

#### **UNIT II**

**Thermodynamics:** The zeroth, first, second and third law of thermodynamics, Free energy functions and applications.

**Physical properties of drug molecules:** Dielectric constant induced polarization, dipole moment, refractive index and molar refraction and optical rotatory dispersion.

#### **UNIT III**

**Solutions of Non electrolytes:** Concentration expressions, ideal and real solutions, colligative properties (lowering of vapour pressure, depression in freezing point, elevation of boiling point and Osmotic pressure), molecular weight determinations.

**Solutions of Electrolytes:** Properties of solutions of electrolytes. The Arrhenius theory of electrolyte dissociation. The modern theory of strong electrolytes (Activity co-efficient and ionic strength).

#### **UNIT IV**

**Ionic equilibria:** Modern theories of acids, bases and salts, Sorensen's pH scale, concentration as a function of pH, calculation of pH and acidity constants.

**Buffers and isotonic systems:** The buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, isotonic solutions, methods of adjusting tonicity and pH (relevant numerical problems).

**Kinetics and drug stability:** General consideration and concepts, half life period ( $t_{1/2}$ ) determination, influence of temperature and Arrhenius theory, light, solvent, catalytic species and other factors. Accelerated stability studies, expiration dating

#### **TEXT BOOKS:**

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences Fifth Edition. Lippincott Williams and Wilkins.
2. C.V.S. Subramanyam, Essentials of Physical Pharmacy, Vallabh Prakashan.
3. Manavalan & Ramaswamy. Physical pharmaceutics. 2<sup>nd</sup> ed. Vignesh publisher, 2008.

#### **REFERENCE BOOKS:**

1. Pharmacopoeia, (I.P., B.P., U.S.P. and European)
2. Martindale, The Extra Pharmacopoeia; latest edition, the Royal Pharmaceutical Society.
3. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
4. L. Lachman, H. Lieberman The Theory And Practice Of Industrial Pharmacy J. L. Kaniz Lee & Febiger Philadelphia, USA.

## **BPH 202: PHARMACEUTICAL ENGINEERING**

### **Unit I**

**Introductory concepts:** Unit operation / Unit processes, material and energy balance, equilibrium state, rate process.

**Fluid Flow:** Types of flow, Reynold's number, Bernoulli's equation, viscosity, concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and principles of measuring instruments.

#### **Material handling systems**

a. Liquid and Gas handling - Study of different types of pumps such as Reciprocating pumps, Turbine pumps and centrifugal pumps, fans, blowers and compressors.

b. Solid handling – Conveyor.

#### **Corrosion:**

Classification, mechanism of corrosion, factors affecting, prevention and control.

### **Unit II**

#### **Dehumidification and Humidity control**

Basic concepts and definition, wet bulb and adiabatic saturation temperature. Psychrometric chart and measurement of humidity, application of humidity measurement, Equipments for dehumidification operations.

**Refrigeration and air-conditioning:** Principles and applications.

**Evaporation and drying:** Basic concept of phase equilibria. Definition and theory of evaporation, factors affecting evaporation, evaporators-film evaporators.

Moisture content and theory of drying, rate of drying and time of drying calculations, drying

curves. Concept of loss on drying and its importance. Classification and types of dryers, dryers used in pharmaceutical industries- tray dryer, Fluid bed dryer, spray dryer, freeze-dryer, tunnel dryer and vacuum dryer.

### **UNIT III**

#### **Crystallization:**

Miers supersaturation theory, crystals growth, size, shape, geometry. Material and heat balances around Swenson walker crystallizer. Nucleation mechanisms, steady of various types of crystallizers, tanks, agitated batch, single vacuum, circulating magma and crystal crystallizer.

**Filtration and Centrifugation:** Theory of filtration, Factors affecting filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, Air filtration. Principles of centrifugation, industrial centrifugal filters and centrifugal sedimenters.

### **UNIT IV**

**Size Reduction:** Definition, theory and objectives of size reduction, factors affecting size reduction,

laws governing energy and power requirements of a mill. A brief study of ball mill, hammer mill, fluid energy mill.

**Size Separation:** Different techniques of size separation, sieves, sieve shakers, sedimentation tank, cyclone separators, bag fillers.



**Mixing:** Theory of mixing, solid-solid, solid-liquid and liquid-liquid mixing equipments-double cone, twin-shell, silverson mixer, colloid mill, sigma blade mixer, planetary mixer, propeller mixer and turbine mixer. Homogenizer, triple roller mill.

**Automated process control systems:**

Process variables, temperature, pressure, flow, level and vacuum and their measurements. Elements of automatic process control and introduction to automatic process control systems, elements of computer aided manufacturing. Reactors and fundamentals of reactors design for chemical reactions.

**TEXT BOOKS:**

1. S.J. Carter, Cooper and Gunn's Tutorial Pharmacy, 6th ed., CBS publisher, Delhi.
2. CVS Subramanyam, Pharmaceutical Engineering. Vallabh Prakasham New Delhi.
3. K. Samba Murthy, Pharmaceutical Engineering new Age International Publishers Ltd. 1998.
4. L. Lachman, H. Lieberman & J.B.Schwartz. Pharmaceutical dosage forms volume-II, 2nd ed., marcel dekker Inc.

**REFERENCE BOOKS:**

1. E.A. Rawlin's, Bentley's Text Book of Pharmaceutics, 8th ed ELBS.
2. Badzer&Banchoro, Introduction to Chemical Engineering. Tata – Mc Graw Hill.

## **BPH 203: PHARMACEUTICAL ORGANIC CHEMISTRY – III**

### **UNIT I: Heterocyclic chemistry**

Definition, nomenclature, structure, aromaticity, reactivity, synthesis, acidity-basicity and characteristic reactions of the following heterocyclic compounds. Few examples of drugs which contain the cited ring system.

**Five membered ring systems:** Furan, pyrrole, thiophene, Pyrazole, imidazole, oxazole, isoxazole, thiazole. **Six membered ring systems:** pyridine, pyrazine, pyrimidine and pyridazine. **Fused ring systems:** Indole, quinoline, iso-quinoline, acridine, Benzimidazole, phenothiazine, purines.

**UNIT II: Stereochemistry of Carbon compounds** - Optical rotation, plane polarized light, optical activity, chirality, notations (assignment of configuration), relative configuration (Fischer DL configuration), absolute configuration (R & S), sequence rules (with examples), enantiomers, meso compounds, racemic mixture and resolution of racemic mixture. Concept of E & Z, Cis & Trans, Syn & Anti configurations. Elements of symmetry. Stereo selective & stereo specific reactions. Optical activity of biphenyl compounds.

### **UNIT III**

**Carbohydrates:** Definition, classification, nomenclature, study of glucose structure, mutarotation, ring structure, oxidation-reduction reactions, osazone formation, epimerization, Lobry De Bruyn – Van Ekenstein reaction, structure of the sucrose, starch and cellulose. non-reducing nature; A brief account on pharmaceutical importance of various carbohydrates. **Glycosides:** Definition, classification,  $\alpha$ ,  $\beta$  – glycosidic linkages, enzymatic hydrolysis, structure and physiological importance of Anthraquinone glycosides.

### **UNIT IV**

**Amino acids and Proteins:** Definition, classification, configuration, methods of preparation of amino acids, physical, chemical properties, Zwitter ionic nature and isoelectric point. peptide synthesis, CTAA and NTAA concept and determination. Structure and chemistry of Insulin, Oxytocin, Heparin. Pharmaceutical importance of polypeptides and proteins.

**Lipids (oils and fats):** Definition, classification of fatty acids, trans and cis fatty acids, fat analysis including Saponification value, acid value, peroxide value and Iodine value etc.), hydrogenation and rancidity of oils and fats. Comparison of fat, oil, wax based on their properties.

### **Reaction mechanisms and applications in Drug synthesis**

Beckmann rearrangement, Birch reduction, Mannich reaction, Michael addition reaction, Wittig reaction, MPV reduction, Oppenauer oxidation, Curtius rearrangement, Schmidt reaction. Neighbouring group effects and reduction by transition metal complexes.

### **TEXT BOOKS:**

1. Heterocyclic chemistry by Bansal, 5<sup>th</sup> edition.
2. Arun Bahl & S.S Bahl, Advanced Organic Chemistry-S.Chand.
3. R Morrison and R. Boyd, organic chemistry, Pub by Printice Hall of India, New Delhi.
4. I L Finar, Organic Chemistry, Vol. I. & II, 6<sup>th</sup> Pearson education
5. O.P Agarwal, A Textbook of Organic Chemistry
6. Eliel, Stereochemistry of Organic compounds.
7. Organic reactions, Stereo chemistry & mechanism by PS Kalsi

### **REFERENCE BOOKS:**

1. Jerry March, Advanced Organic Chemistry 4<sup>th</sup> Edition Wiley Publication.
2. Cram & Hammond. Organic Chemistry Mc Graw-Hill.
3. A.I. Vogel's, A textbook of practical organic chemistry Mc Graw Hill. 6<sup>th</sup> Edition.
4. Solomons, Organic Chemistry 9<sup>th</sup> Edition Wiley Publication.

## **BPH 204: PHARMACEUTICAL BIOCHEMISTRY**

### **UNIT I:**

#### **Cell Processes, Bioenergetic and Cellular Reactions**

Bio chemical organization of the cell, molecular constituents of membrane, active & passivetransport process, sodium and potassium pumps, osmoregulation and heamostatis. The concept of freeenergy, determination of change in free energy from equilibrium constant & reduction potential.

Production of ATP and its biological significance.

### **UNIT II**

**Introduction to Bio-Molecules:** Structure, classification, cell and biological functions of carbohydrates, proteins, lipids, nucleic acids (DNA & RNA) vitamins & minerals.

**Enzymes & Co-Enzymes:** Classification, Structure, mechanism of action, properties, factors

affecting enzymes action, enzyme kinetics and enzyme inhibitions, Coenzymes from Vitamins, Nucleotides and non-nucleotides. clinical importanceof enzymes in treatment and diagnosis.

### **UNIT III : Metabolism of carbohydrates**

Metabolic pathway, regulation and significance of the following pathways and cycles: Metabolism ofCarbohydrates: Glycolysis (aerobic and anaerobic), glycogenolysis, gluconeogenesis, Kreb's cycle,HMP &uronic acid pathways, Cori cycle.

### **UNIT IV : Metabolism of Lipids and Proteins**

**Lipids :** Alpha, Beta, Gama & Omega oxidations of fatty acids, bio-synthesis of fatty acids,

cholesterol, ketogenesis, Utilization of ketone bodies, ,Metabolic disorders of lipid metabolism.

**Proteins:** Structure, classification of protein. Classification of aminoacids, concept of essential andnonessential amino acids and their importance in deamination, Trans-amination, de-carboxylation,Urea cycle. Metabolism of Valine, cystine, cystein, tryptophan, tyrocine, methionine.Biosynthesis ofpurines, pyrimidines, proteins.Metabolic disorders of Carbohydrate and protein.

#### **Clinical Biochemistry**

Introduction to clinical biochemistry, Normal values of various biochemical parameters (Blood / orUrine: Glucose, VLDL, LDL etc. total proteins, urea, Minerals, Hormones... etc.) and their abnormalvalues in diagnosis.Liver function test and kidney function test, OGTT.

### **TEXT BOOKS:**

1. A.L.Lehninger, Principles of Biochemistry; CBS Publishers and distributors.
2. Harper, Biochemistry McGraw Hill Medical, 28th Edition.
3. Text Book of Biochemistry by Satyanarayana Oxford University Press.
4. J.L.Jain, Fundamentals of Biochemistry S.Chand

### **REFERENCE BOOKS:**

1. Biochemistry, C.B.Powar&G.R.Chatwal, Himalaya publishing house
2. L.Stryer, Text Book of Bio Chemistry. W.H.Freemann& Co. Ltd. 6th Edition.
3. West, Edward Text Book of Biochemistry; Freeman and company, Sanfransisco.
4. E.E.Conn and PK Stumpf, Outlines of Biochemistry; John Wiley and sons, New York.

## **BPH 205: ENVIRONMENTAL STUDIES**

### **UNIT – I**

**MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES:** – Definition, Scope and Importance – Need for Public Awareness.

**NATURAL RESOURCES :** Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

### **UNIT – II**

**ECOSYSTEMS:** Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem.
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**BIODIVERSITY AND ITS CONSERVATION :** Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

### **UNIT – III**

**ENVIRONMENTAL POLLUTION:** Definition, Cause, effects and control measures of :

- a. Air Pollution.
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards

**SOLID WASTE MANAGEMENT:** Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

### **UNIT – IV**

**SOCIAL ISSUES AND THE ENVIRONMENT:** From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global

warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

**HUMAN POPULATION AND THE ENVIRONMENT:** Population growth, variation among nations. Population explosion – Family Welfare Programmed. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

**Text Books:**

1. Text Book of Environmental Studies for Undergraduate Courses, Erach Bharucha, Universities Press Pvt Ltd, Hyderabad. 2<sup>nd</sup> Edition 2013.
2. Environmental Studies by Kaushik, New Age Publishers.

**References:**

1. Environmental Studies by Rajagopalan, Oxford Publishers.
2. Comprehensive Environmental studies by J.P.Sharma, Laxmi publications.

Introduction to Environmental engineering and science by Gilbert M. Masters and Wendell P. Ela - Printice hall of India Private limited.

**BPH 206: PHYSICAL PHARMACY –I PRACTICALS****I. EXPERIMENTS:**

1. Molecular weight – Rast camphor method.
2. Calibration of pH Meter using standard buffers pH Estimation – pH meter.
3. pKa Estimation by Half Neutralization Method.
4. Refractive index of liquids.
5. Phenol water system – CST.
6. Lower consolute temperature – TEA (Tri Ethyl Amine) and Water.
7. Ternary phase diagram.
8. Preparation of phosphate Buffers and their Buffer Capacity Determination.
9. Effect of temperature on first order kinetics and to find the energy of activation.

**II. Demo/ Workshop**

Demo on polarimeter (To prove that the hydrolysis of sucrose follows first order kinetics).

**III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

Thermodynamics of solutions and polymers, Types of electrodes.

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Ostwald's viscometer
2. Stalgnometer
3. Polarimeter
4. Abbe's refractometer
5. CST apparatus
6. pH meter
7. Colorimeter
8. Digital balances

## **BPH 207: PHARMACEUTICAL ENGINEERING PRACTICALS**

### **I. EXPERIMENTS:**

1. Evaluation of filter media, determination of rate of filtration and study of factors affecting filtration Including filter aids.
2. Particle size measurement by sieve shaker.
3. Determination of Humidity-using Dry Bulb and Wet Bulb thermometers and Psychometric charts.
4. Determination of overall Heat Transfer Coefficient.
5. Determination of rate of evaporation.
6. Determination of rate of drying, free moisture content and bound moisture content.
7. Experiments to illustrate the influence of various parameters on construction of drying curves.
8. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of a size reduction (Ball mill).
9. Experiments to illustrate solid-solid mixing, determination of mixing efficiency using different types of mixers.
10. Analysis of pharmaceutical packaging materials-leaching of contents from packaging materials.

### **II. DEMO/ WORKSHOP**

Determination of type of flow (Reynolds experiment)

Double cone blender, homogenizer, tray dryer.

### **III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

Advances in packaging technology.

### **LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Tray dryer
2. Ball mill
3. Sieve shaker with set of sieves as per IP
4. Double cone blender
5. Propeller type mechanical agitator
6. Homogeniser
7. Buchner filtration apparatus
8. Vacuum pump
9. Desiccators
10. Energy meter
11. Autoclave

## **BPH 208: PHARMACEUTICAL ORGANIC CHEMISTRY – III PRACTICALS**

### **I. Experiments:**

#### **A. Quantitative determination of organic compounds via functional groups**

1. Phenolic groups by bromination method.
2. Alcoholic group by acetylation method.
3. Carbonyl group by hydroxylamine hydrochloride-pyridine method.
4. Aldehyde group by sodium sulphite-sulphuric acid procedure.
5. Carboxyl group by acid-base method.
6. Amino group by bromination method.
7. Amino acid formal titration method.

#### **B. Synthesis/preparation involving more than one step (Any five).**

8. Synthesis of acetophenone oxime and its conversion to acetamide.
9. Phenothiazine from diphenyl amine
10. Benzimidazole from o-phenylene diamine
11. Knorr quinoline synthesis (4-methyl 2- quinoline) from aceto acetanilide
12. Synthesis of Imidazole -4,5-dicarboxylic acid from tartaric acid
13. Benzilic acid from benzene.
14. Preparation of 2-phenylindole from Phenylhydrazine by Fischer's method.

#### **C. Analysis of oils & fats**

- a. Determination of Acid value of fixed oils.
- b. Determination of Saponification value of a fixed oils.
- c. Determination of Iodine value of a fixed oils.
- d. Determination of peroxide value of a fixed oils.

### **II. Demo/Workshop:**

Synthesis of some asymmetric organic molecules, identification of synthesized compounds by TLC, Catalyst and solvent effect in synthesis.

### **III. Seminar/Assignment/Group discussion:**

Principles of green chemistry, solvent free synthesis, sonication as the green chemical method for organic synthesis.

### **References:**

1. Indian Pharmacopoeia. – 1996.
2. A.I. Vogel's – Practical Organic Chemistry – Prentice Hall.
3. Text Book of Practical Organic Chemistry, Vogel's, 5<sup>th</sup> Edition Pearson.
4. Laboratory Manual of Organic Chemistry, R.K. Bansal, New Age International 5<sup>th</sup> Edition 2007.
5. Advanced Practical Organic Chemistry, O.P. Agarwal, 3<sup>rd</sup> Edition Goel Publication.  
Practical Organic Chemistry, F.G.Mann & B.C. Saunders, Pearson 4<sup>th</sup> Edition



**BPH 209:. PHARMACEUTICAL BIOCHEMISTRY PRACTICALS****I. EXPERIMENTS:**

1. Identification of carbohydrates
2. Identification of amino acids.
3. Identification of lipids.
4. Estimation of glucose in urine and blood.
5. Estimation of creatinine in urine.
6. Estimation of creatinine in blood.
7. Estimation of cholesterol in blood.
8. Estimation of Urea in Blood
9. Estimation of Serum protein.
10. Estimation of bile pigments in serum.
11. Estimation of alkaline phosphatase, SGOT, SGPT in serum
12. Effect of temperature on the activity of alpha-amylase.

**NOTE:**Collection of blood samples from human should be carried out by trained pathologist and subject as per norms from the human subject.

**II. WORKSHOP / DEMO**

Different diagnostic methods in diagnostic lab, Blood Glucose estimation by Glucometer

**III. SEMINAR / ASSIGNMENT/GROUP DISCUSSION**

Various diagnostic tests for different diseases, Gene therapy and gene targetting

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Colorimeter
2. Table top centrifuge
3. Digital balance
4. Physical/chemical balance
5. pH meter
6. Water bath
7. Folin-Wu tubes
8. Autoanalyser
9. Adequate glass wares

**II B.PHARM- II SEMESTER****BPH 209: PHYSICAL PHARMACY –II****UNIT I**

**Solubility and distribution phenomena:** Solvent-solute interaction, solubility of gases in liquids, solubility of liquids in liquids, solubility of solids in liquids, distribution of solutes in immiscible solvents.

**Introduction to phenomena of diffusion:** Fick's first law and second law.

**Complexation:** Classification of complexes, methods of preparation, analysis and applications.

**UNIT II**

**Interfacial Phenomena:** Liquid interfaces, spreading coefficient, measurement of surface and interfacial tensions, adsorption at liquid interfaces. Adsorption isotherms only (Freundlich's isotherms and Langmuir's isotherms). Surface-active agents and HLB classification, solubilization, detergency. Parachor, Adsorption at solid interfaces. Solid gas and solid liquid interfaces, complex films, electrical properties of interfaces.

**UNIT III**

**Micromeritics and Powder Rheology:** Particle size and size distribution, number and weight distribution, particle number, methods for determining particle volume, methods of determining particle size: optical microscopy and sedimentation, measurement of particle shape, specific surface area: methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness and flow properties.

**UNIT IV**

**Rheology:** Newton's law of flow, kinematic viscosity, effect of temperature, Newtonian systems, non-Newtonian systems: pseudoplastic, dilatant, plastic, thixotropy, negative thixotropy. Determination of viscosity, capillary, falling ball and rotational viscometers.

**Colloids:** Introduction, types of colloidal systems, protective colloids, applications of colloids in pharmacy.

**Coarse Dispersions:**

Suspensions: Types and theories of suspensions, effect of Brownian motion, interfacial properties of suspended particles, settling in suspensions. Sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations.

Emulsions: Theories of emulsification, physical stability of emulsions.

**TEXT BOOKS:**

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences 5th Edition. Lippincott Williams.
2. CV Subrahmanyam, Physical Pharmaceutics, Vallabhprakashan.
3. Manavalan & Ramaswamy. Physical pharmaceutics. 2nd ed. Vignesh publisher, 2008.

**REFERENCE BOOKS:**

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
2. L. Lachman, H. Lieberman The Theory And Practice Of Industrial Pharmacy J. L. Kaniz  
Lee & Febiger Philadelphia, USA

## **BPH 211: PHARMACEUTICAL ANALYSIS – I**

### **UNIT I**

a) Definition of Analytical chemistry and role of pharmaceutical analysis in pharmaceutical industry.

Significant figures, concept of error, precision, accuracy, rejection of doubtful values with special reference to volumetric analysis. Calibration of glassware used in volumetric analysis-Burette, pipette and volumetric flask. Methods of expression of concentration(w/w,w/v,v/v).

b) **Theory of Neutralization Titrations:** Acid-base concept, Acidimetry, Alkalimetry, Common ion effect and solubility product, indicators, Ostwald and quinonoid theories of Indicators

c) **Non-aqueous titration:** Theory, types, solvents used and application in pharmaceutical analysis.

**Application of the above methods in the analysis of drugs and formulations as under IP 2007and 2010.**

### **UNIT II**

a) General principles, theory and examples of **oxidation-reduction methods**, permanganometry, cerimetry, iodometry, iodimetry indicators used in these titrations, self indicators.

b) General principles, theory and examples of **Precipitation methods:** Mohr's method, volhard's method, account of the indicators used in these titrations, Adsorption indicators.

c) **Complexometric titration:** Theory, types and application in pharmaceutical analysis. Indicators used, Masking and demasking and their applications.

**Application of the above methods in the analysis of drugs, as under IP 2007and 2010.**

### **UNIT III**

a) Potentiometry: Introduction to EMF, electrochemical cells and half cells, Electrodes, measurement of potential, pH curve, EMF curve, derivative curve in application to end point determination.

b) Conductometric titrations: Basic concepts, conductivity cell, different types of conductometric titrations.

c) Polarography: Basic concepts, apparatus and principles, different currents, polarographic maxima, general polarographic analysis, applications in identification and quantification of metals.

d) Amperometric titrations with one polarized electrode, general procedure, titration curves, applications in pharmaceutical analysis.

### **UNIT IV**

**Fluorimetry:** Theory, Fluorescence and chemical structure, stokes and anti-stokes, quantum efficiency,factors affecting the intensity of fluorescence, Instrumentation (double beam), Applications inPharmaceutical analysis.

**Flame Emission photometry Vs Atomic absorption spectroscopy:** Emission spectra, Absorptionspectra, line spectra, principle of absorption / emission of UV light by elements, instrumentation,applications in pharmaceutical analysis. Focus on interference.

**Nephelo-turbidimetry:** Introduction, principle, instrumentation of Nephelo-turbidimeter,pharmaceutical application as specified in IP, determination chlorides and

sulphates.

a) Principle and applications of the following instruments and various grades of reagents a in QC laboratory.

i) Refractometry ii) Polarimetry. iii) LR Grade iv) AR grade v) HPLC grade.

b). Role of moisture content determination in QC of pharmaceuticals (including Karl-Fisher method, LOD, IR balance).

**TEXT BOOKS:**

1. A.H. Beckett & J.B Stanlake Vol. I & II., Practical Pharmaceutical Chemistry, Athlone Press of the Univ of London

2. B.K. Sharma, Instrumental Chemical Analysis, Goel Publishers.

3. Chatwal & Anand, Instrumental Methods of Analysis. Himalaya Publishing Home, 2009.

**REFERENCE BOOKS:**

1. A.I Vogel, Quantitative Chemical Analysis, VI edition, Pearson education Delhi.

2. Pharmacopoeia (IP, BP, USP).

3. D. A. Skoog, Principles of Instrumental Analysis, V edition, Thomson Brooks Bangalore.

4. Connors, a Textbook of Pharmaceutical Analysis. Wiley India Pvt. Ltd

## **BPH 212: PHARMACEUTICAL TECHNOLOGY – I**

### **UNIT I**

**Preformulation:** Goals, Physicochemical properties like physical form, particle size, shape, density, wetting, dielectric constant, solubility, dissolution, partition coefficient, organoleptic additives, hydrolysis, oxidation-reduction, racemization, polymerization, etc and their effect on formulation, drug-excipient incompatibility studies,. Introduction to Stability testing of finished products as per ICH guidelines.

### **UNIT II**

**Liquid dosage forms:** Introduction, types of additives used in formulations, vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizers, colors, flavours and others, manufacturing packaging and evaluation of clear liquids, suspensions and emulsions official in pharmacopoeia.

**Dry syrups:** Requirements, formulation, methods of preparation, containers, evaluation.

### **UNIT III**

**Semisolid dosage forms:** Definitions, types, mechanisms of drug penetration, factors influencing penetration, semisolid bases and their selection. General formulation of semi solids, clear gels manufacturing procedure, evaluation and packaging.

**Suppositories:** Ideal requirements of bases, Different types of bases, displacement value, manufacturing procedure, packing and evaluation.

### **UNIT IV**

**Pharmaceutical aerosols:** Definition, propellants general formulation, manufacturing and packaging methods, pharmaceutical applications. Quality control tests for aerosols.

**Blood Products and Plasma Substitutes:** Collection, processing and storage of whole human blood, Concentrated human RBC's, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin, foam plasma substitutes, ideal requirements, PVP, Dextran etc. For control of blood pressure as per IP.

### **Text Books:**

1. L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea & Febieger, Philadelphia Latest Edn.
2. L. V. Allen Jr., N. G. Popovich, H. C. Ansel. Ansel's pharmaceutical dosage forms and drug delivery systems. Lippincott Williams & Wilkins, 2005.
3. M. E. Aulton Pharmaceutics. The science of dosage form design. - 2nd ed. Churchill-Livingstone, 2002
4. B.M.Mithal. a text book of pharmaceutical formulations, 6thed., vallabh prakashan, 2010.

### **Reference Books:**

1. Banker and Rhodes, Modern pharmaceutics, marcel dekker series.
2. James Swarbrick, Encyclopedia of pharmaceutical technology, 3 rd edi, informa healthcare.

## **BPH 213: PHARMACOGNOSY – II**

### **UNIT I**

#### **Glycosides**

Definition, classification, properties and general tests of glycosides and detailed Pharmacognostic study of the following glycosides containing drugs:

- a. **Saponin glycosides**- Glycyrrhiza, Ginseng, Dioscorea, Senega, Sarsaparilla
- b. **Cardioactive glycosides**-Digitalis, Squill, Strophanthus, Thevetia
- c. **Anthraquinone glycosides**-Aloe, Senna, Rhubarb, Cascara
- d. **Bitter Glycosides**- Psoralea, Gentian, Chirata

### **UNIT II**

A) General introduction to cosmeceuticals, role of herbs in cosmetics.

- Study of the following cosmeceuticals - Amla, Henna, Cyperus, Soap Nut, Aloe Vera, Turmeric, Sandal Wood and Bitter Orange Peel.

B) Definition and study of Nutraceuticals: Garlic, Spirulina, Soya and Royal jelly.

### **UNIT III Alkaloids:**

Definition, classification, properties and general tests and detailed pharmacognostic study of the following alkaloid containing drugs:

- a. **Pyridine-Piperidine alkaloids**- Tobacco, Lobelia
- b. **Tropane**- Belladonna, Hyoscyamus, Datura, Coca.
- c. **Indole**-Ergot, Rauwolfia, Vinca, Nux Vomica
- d. **Imidazole**-Pilocarpus
- e. **Steroid**- Kurchi, Veratrum, Aswagandha

### **UNIT I a. Quinoline-Isoquinoline-Cinchona, Ipecac, Opium**

- b. **Alkaloidal amine**- Ephedra, Colchicum
- c. **Glycoalkaloid**-Solanum
- d. **Purine**-Coffee, Tea, cola
- e. **Quinazoline** -Vasaka

A) **Biogenesis**: General techniques of biosynthetic studies and basic metabolic pathways.

- Biogenesis of secondary metabolites of pharmaceutical importance.

B) **Extraction of herbal materials**: Definition of extraction, principle involved in extraction, different types of extraction.

- Factors affecting the process of extraction.

C) **Phytochemical Screening**: Preparation of extracts, identification and screening of alkaloids, saponins, cardiac glycosides, flavonoids, tannins and anthraquinones in plant extracts.

#### **Text Books:**

1. Kokate CK, Purohit A.P. & Gokhale; Pharmacognosy Nirali Prakashan, New Delhi.
2. Text book of Pharmacognosy by Handa and Kapoor.
3. Peach K and Tracey MV, Modern methods of Plant analysis, Narose publishing house, New Delhi.
4. Pharmacognosy by Brady & Tyler.
5. Tutorial Pharmacy by Cooper and Gunn.
6. text book of pharmacognosy and phytochemistry by Vinod D Rangari, Vol I and II.

#### **Reference Books:**

1. Text book of Pharmacognosy by Wallis.
2. Herbal drug technology by Pulok Mukharjee
3. Pharmacognosy by Trease and Evans
4. Biosynthesis of natural products by Manitto P
5. Harbone JB, Phytochemical methods, Chapman and Hall

## **BPH 214: PHARMACoinFORMATICS & BASICS IN DRUG DISCOVERY**

### UNIT-1

Classification of Pharmacoinformatics: Bioinformatics, Genome Informatics, Immunoinformatics, Neuroinformatics, Toxic Informatics, Metabolome Informatics, Healthcare Informatics, Nursing informatics, Chemo informatics

### UNIT-2

Basics in Drug Discovery:

Identification of new lead structures, Optimization of lead structures, Establishment of quantitative structure activity relationships (QSAR), Comparison of chemical libraries.

### UNIT-3

Definition and analysis of structural diversity, Planning of chemical libraries, Docking of a ligand into a receptor, De novo design of ligands, Modeling of ADME-Tox properties, Drug design based on pharmacophore and virtual library screening.

### UNIT-4

Disciplines of bioinformatics, transcriptomics, functional genomics, structural genomics, metabolomics, pharmaco-genomics

### **TEXT BOOKS**

1. Developing Bioinformatics Skills. Alfonso Valencia and Blaschke. L (2005) Oreille.s Publication.
2. Bioinformatics sequence, structure and data banks ed. By Des Higgins Willie Taylor. (2006).
3. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins" (Andreas D. Baxevanis, B. F. Ouellette), Paperback, 2nd ed., 470 pp., ISBN: 0471383910, Publisher: Wiley, John & Sons, Inc., Pub.
4. David W. Mount, Bioinformatics: Sequence and Genome Analysis, 2nd edition, Cold Spring Harbor Laboratory, 2004, ISBN 0-87969-687-7.
5. Introduction to Bioinformatics by T.K.Altwood and D.J Parry-Smith (Pearson Education Asia 1999).

## **BPH 215: PHYSICAL PHARMACY –II PRACTICALS**

### **I. EXPERIMENTS:**

1. Determination of bulk density, true density and percentage porosity.
2. Effect of particle size and effect of glidant on angle of repose.
3. Study of particle/globule size distribution by optical microscopy
4. Determination of CMC of a surfactant.
5. Determination of partition coefficient

Iodine between water and carbon tetrachloride

6. Determination of sedimentation volume and degree of flocculation.
7. Effect of addition of Salt/pH/co-solvent on the solubility
8. Surface tension using Stalagmometer.
9. HLB value estimation of surfactants.
10. Viscosity – by Ostwald Viscometer.

### **II. DEMO/ WORKSHOP**

Determination of particle size by AndreasonPippette, Plotting of an adsorption isotherm  
Brook field viscometer.

### **III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

Viscoelasticity, solubilisation techniques

### **References**

1. Physical Pharmaceutics, By Mohanta, and Guru Prasad B.S. Publications

### **List Of Minimum Equipments Required**

1. Ostwald's viscometer
2. Stalgnometer
3. Digital pH meter
4. Microscopes
5. Stage and eyepiece micrometer
6. Digital electronic balance
7. Thermometer
8. Andreasonpipetter
9. Adequate glasswares



**BPH 216: PHARMACEUTICAL ANALYSIS – I PRACTICALS****I. Experiments:**

- 1 Calibration of analytical glass ware.
- 2 Assay of Sodium carbonate by acid-base titration.
- 3 Assay of Ferrous sulfate (redox) ceric ammonium sulfate titration.
- 4 Assay of Sodium benzoate by non-aqueous titration.
- 5 Assay of Sodium chloride by precipitation titration.
- 6 Assay of Calcium gluconate by complexometry.
- 7 Potentiometric titration : Determination of strength of unknown solution HCl, HCl – Acetic acid mixture) against std. NaOH Solution.
- 8 Assay of any drug by potentiometry, (eg. Frusemide, metronidazole).
- 9 Conductometric titration – Determination of strength of unknown solution (HCl, HCl– Acetic Acid mixture) against std. NaOH Solution.
- 10 Determination of refractive index of any sample by Abbe's refractometer.
- 11 Determination of sucrose concentration by Polarimetry.
- 12 Determination of moisture content by Karl-Fishcer reagent.

**II. Demo/work shop**

1. Demonstration on gel electrophoresis
2. Demonstration on Polarography

**III. Seminar/Assignment/Group discussion**

1. List out various drugs that can be assayed by acid-base titration, as per I.P.2007.
2. What is the need of determination of moisture content, what is the limit of moisture in various natural and synthetic drugs?

**BPH 217: PHARMACEUTICAL TECHNOLOGY–I PRACTICALS****I. EXPERIMENTS:**

1. Preparation, evaluation and packaging of
  - a) Solutions: Paracetamol syrup, codeine phosphate linctus
  - b) Ferrous sulphate syrup
  - c) Suspensions: Milk of magnesia
  - d) Emulsions: o/w or w/o type
  - e) Benzyl benzoate lotion
  - f) Ointments: Benzoic acid ointment
  - g) Methyl salicylate ointment
  - h) Suppositories: Boric acid
  - i) Eye drops: Gentamycin.
  - j) Eye ointments: Chloramphenicol.
  - k) Sodiumchloride eye lotion
  - l) Cream: Cetrimide
  - m) Cold cream
  - n) Zincoxide jelly
  - o). Preparation of gel

**II. DEMO/ WORKSHOP**

Drug-excipient incompatibility studies, ointment filling machine.

**III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

- 1) Excipients and their concentrations in various dosage forms.
- 2) Seminar on blood products

**BPH 218: PHARMACOGNOSY – II PRACTICALS****EXPERIMENTS:**

1. Study of various morphological characters of the drugs mentioned in theory under alkaloids
2. Study of various morphological characters of the drugs mentioned in theory under glycosides.
3. Microscopy (Transverse section & powder) of Datura and Vinca leaf
4. Microscopy (Transverse section & powder) of Cinchona and Ephedra
5. Microscopy (Transverse section & powder) of Nux vomica and Rauwolfia
6. Microscopy (Transverse section & powder) of Digitalis and Senna
7. Microscopy (Transverse section & powder) of Squill and Liquorice
8. Preparation and evaluation of any one herbal cosmeceutical preparation
9. Preliminary phytochemical screening of any one plant
10. Determination of crude fibre content for any one nutraceutical listed under theory.

**Seminar/ Assignment/Group discussion**

Seminar/assignment related to theory.

**Workshop/Demo**

Extraction of plant material using Soxhlet apparatus

**References**

1. Practical Pharmacognosy, C K Kokate, Nirali Prakashan
2. Practical Pharmacognosy, Khandelwal, Nirali Prakashan
3. Practical Pharmacognosy Iyengar, Manipal Press Ltd.
4. Peach K and Tracey MV, Modern methods of Plant analysis, Narose publishing house, New Delhi.

### **III B.PHARM- I SEMESTER**

#### **BPH 301: PHARMACEUTICAL TECHNOLOGY-II**

##### **UNIT I**

**Capsules:** Advantages and disadvantages of capsule dosage forms, material for production of hard and soft gelatin capsules, sizes of capsules, capsule filling, soft processing problems in capsule manufacturing, importance of base absorption and minimum/gm factors in soft capsules, quality control, stability testing and storage of capsule dosage forms.

##### **UNIT II**

**Microencapsulation:** Types of microencapsulation and importance of microencapsulation in pharmacy, microcapsulation by coacervation phase separator, multi orifice centrifugal separation. Spray drying, spray congealing, polymerization complex emulsion, air suspension technique, and pan coating techniques, evaluation of microcapsules.

##### **UNIT III**

**Tablets:** Introduction to different types of tablets, Formulation of tablets, direct compression, Granulation technology on large-scale by various techniques and equipments. Tablet processing problems and their remedy. Physics of tablet making. Types of tablet compression machinery and the equipments employed and evaluation of tablets.

**Coating of Tablets:** Types of coating, coating materials and their selection, formulation of coating solution, equipment for coating, coating processes, evaluation of coated tablets. Tablet coating defects and their remedy.

##### **UNIT IV**

###### **Parenteral Products**

- Preformulation factors, routes of administration, water for injection, treatment of apyrogenicity, non-aqueous vehicles, isotonicity and methods of its adjustment.
- Formulation details, containers, closures and their selection.
- Prefilling treatment, washing and sterilization of containers and closures, preparation of solutions and suspensions, filling and closing of ampoules, vials, infusion fluids, lyophilization & preparation of sterile powders, equipment for large-scale manufacture and evaluation of parenteral products.
- Aseptic techniques, sources of contamination and methods of prevention. Design of aseptic area, laminar flow benches, Environmental control monitoring.

###### **Packaging of Pharmaceutical products:**

Packaging components, types, specifications and methods of evaluation as per I.P. Factors influencing choice of containers, package testing, legal and other official requirements for containers, packing testing. Methods of packing of solid, liquid and semi-solid dosage forms, Factors influencing packing material, stability aspects of packaging.

###### **Text Books:**

- L. Lachman, H.A, Lieberman and J.L. Kanig, Theory & Practice of industrial pharmacy, Lea & Febieger, Philadelphia Latest Edn.
- L. V. Allen Jr., N. G. Popovich, H. C. Ansel. Ansel's pharmaceutical dosage forms and drug delivery systems. Lippincott Williams & Wilkins, 2005.
- M. E. Aulton Pharmaceuticals. The science of dosage form design. - 2<sup>nd</sup> ed. Churchill-Livingstone, 2002

4. B.M.Mithal. a text book of pharmaceutical formulations, 6<sup>th</sup>ed, vallabh prakashan, 2010.
5. U.K.Jain, D.C.Goupale & S.Nayak. Pharmaceutical packing technology. 1<sup>st</sup>ed, pharmamed press, 2009.

**Reference Books:**

1. Sagarin & MS Balsam, Cosmetics Sciences &Technology Vol.1, 2 & 3 Wiley India Pvt. Ltd.
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences.
3. E.A.Rawlkins, Bentley's Text Book of Pharmaceutics, Elbs publ
4. Banker and Rhodes, Modern pharmaceutics, marcel dekker series.
5. L. Lachman, H.A, Lieberman and J.L. Kanig,Tablet vol I,II and III. marcel dekker series.
6. James Swarbrick, Encyclopedia of pharmaceutical technology, 3 rd edi, informa healthcare.
7. NK Jain, Pharmaceutical product development, CBS publishers.

## **BPH 302: MEDICINAL CHEMISTRY-I**

### **UNIT I**

Physico chemical properties of drug molecules in relation to biological activity – Solubility, lipophilicity, partition-coefficient, Ionization, hydrogen bonding, Chelation, redox potential and surface activity, Bioisosterism and steric features of drugs, drug distribution and protein binding. Mechanisms of Drug action: Introduction, Enzyme stimulation, Enzyme inhibition. Theories of drug action (Ferguson's, Dale's, perturbation and occupation). Drug metabolism: Introduction to Biotransformation, concept of soft and hard drug, phase I & II (With one drug example). Introduction, basic concepts and clinical importance of Prodrug and criteria for drug latentiation approach.

**NOTE:** Introduction, definition, chemical classification with structure, nomenclature, synthesis (only for \* marked drugs), mechanism of action, SAR including stereo chemical aspects, metabolites (including its ADR) and therapeutic uses of the following classes of drugs from UNIT II to UNIT V.

### **UNIT II        Drugs acting on ANS**

Adrenergic and antiadrenergic agents: Adrenergic agonist: Chemistry and metabolism of neurotransmitters, Dopamine, Epinephrine, Ephedrine\*, Phenylephrine, Isoprenaline\*, Naphazoline, Oxymetazoline\*, Terbutaline, Salbutamol\*, Salmeterol, metarminol. Adrenergic antagonist: Classification, Phenoxy benzamine\*, Prazosin\*, Tamsulosin, Propranolol, Atenolol\*, Metaprolol, Labetolol, Esmolol. SAR- Sympathomimetics (Catecholamines)

Cholinergic and anti-cholinergic agents: Cholinergic receptor and neuro chemistry and concept of neuro muscular blocking agents. Succinylcholine\*, Methacholine, carbachol, pilocarpine\*, Physostigmine, pyridostigmine, Neostigmine, Malathion, Pralidoxime, Propantheline, Nicotine, Dicyclomine\*, Biperiden\*, Decamethonium\*, pancuronium. SAR- Cholinergic agonists, Anti-cholinergics, Neuro muscular blockers.

### **UNIT III**

CNS system Depressants and Central dopaminergic signalling agents

Anxiolytics, Sedatives and Hypnotics: Benzodiazepines (Diazepam\*, Oxazepam, Nitrazepam, Clonazepam, Midozolam, Alprazolam\*), Barbiturates (Phenobarbital\*, Amobarbital, Pentobarbital, Secobarbital), Glutethimide\*, Meprobamate\*, methocarbamol, Methypylon. SAR-Benzodiazepines, Barbiturates.

Anti-Psychotics: Phenothiazines (Chlorpromazine\*, Thioridazine, Fluphenazine), thioxanthines (Thiothixene\*), Butyrophenones (Haloperidol\*, Droperidol, resperidone, penfluridol), Miscellaneous-Lithium salts, Clozapine and Olanzapine. SAR- Phenothiazines, Butyrophenones.

Anti-convulsants: Phenytoin\*, Valproic acid, Carbamazepine\*, Primidone, Ethosuximide\*, Gabapentin, Lamotrigine, Levetiracetam, Zonisamide, Topiramate. SAR- Hydantoins, Oxazolidinediones, Succinimides. Anti-parkinsonism: Levodopa\*-Carbidopa, Amantidine\*, Selegiline, Apomorphine, Ropinirole, Entacapone, Tolcapone.

### **UNIT IV**

Analeptics: PicROTOXIN, Doxapram\*, Methyl xanthines (Caffeine, Theophylline, Theobromine) Psychomotor stimulant: Dextro amphetamine\*, Methamphetamine, Phenfluramine, Sibutramine, Methylphenidate. Anti-depressants: Types, Phenelzine, Tranylcypromine\*, Tricyclic anti-depressants: Imipramine\*, Desipramine, Amytriptyline\*, Doxepin\*, Fluoxetine\*, Sertraline, Newer agents: Venlafaxine,

Buspirone, Mirtazapine and Bupropion. SAR- Tricyclic antidepressants, MAOIs. Miscellaneous: Psilocybin, Dimethyltryptamine, Mescaline, Lysergic acid and Tetrahydrocannabinol.

#### Anaesthetics

General anaesthetics: Chemical classification, Inhaled and Injectable, Meyer-Overton theory, Halothane\*, Isoflurane, Sevoflurane, Triflurane, Propofol, Ketamine, Etomidate, Thiopental sodium\*. Local anaesthetics: Cocaine, Lignocaine\*, Procaine\*, benzocaine, Ropivacaine, Bupivacaine, Articaine. Adjuvant to local anaesthetics. SAR- Esters and amides.

#### Reference Books:

1. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.
2. An Introduction to Medicinal Chemistry by Graham. L. Patrick, Oxford University publishers.
3. JH Block & JM Beale (Eds), Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcolt, Raven, Philadelphia, 2004
4. Rama Rao Nadendla, Medicinal Chemistry; Mc Millan Publishers.
5. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, Oxford
6. D. Abraham (Ed), Burger Medicinal chemistry and Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6th Ed.
7. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Ed: 1. Oxford University Press, Delhi.
8. Daniel Lednicher, Strategies for Organic Drug Synthesis and Design, John Wiley, N. Y. 1998.
9. D. Lednicher, Organic drug synthesis, Vol, 1 – 6, J.Wiley N.Y

## **BPH 303: PHARMACOLOGY-I**

### **UNIT I**

#### **General Pharmacology**

Definition, historical development and scope of pharmacology. Sources of drugs and routes of administration. Principles of discovery and development of new drugs, phases of clinical trials.

#### **b. Pharmacodynamics**

Mechanism of action with special emphasis on receptors, drug-receptor interaction theories, factors modifying drug action.

#### **c. Pharmacokinetics**

Drug absorption, distribution, metabolism and excretion. Factors affecting/modifying pharmacokinetic parameters.

### **UNIT II**

#### **Pharmacology of Peripheral Nervous System**

- a. Neurohumoral transmission (autonomic and somatic), cholinergic receptors and adrenergic receptors.
- b. Parasympathomimetics, parasympatholytics, sympathomimetics and sympatholytics.
- c. Ganglionic stimulants and blocking agents.
- d. Neuromuscular blocking agents and local anesthetic agents.

### **UNIT III**

#### **Pharmacology of Central Nervous System: I**

- a. Neurohumoral transmission in the C.N.S with special emphasis on dopamine, GABA and 5-HT neurotransmission.
- b. General anesthetics, sleep cycle, sedatives, hypnotics and anti-anxiety agents.
- c. CNS stimulants and centrally acting muscle relaxants.
- d. Alcohols and disulfiram. Drug addiction, abuse, tolerance and dependence.

### **UNIT IV**

#### **Pharmacology of Central Nervous System: II**

- a. Pharmacology of drugs used in affective/mood disorders like depression and mania.
- b. Pharmacology of drugs used in neurodegenerative disorders like parkinsonism and Alzheimer's disease.
- c. Pharmacology of drugs used in behavioral disorders like psychosis.
- d. Pharmacology of drugs used in epilepsy
- e. Analgesics, Antipyretics, Anti-inflammatory and Anti migraine drugs.
- f. Narcotic analgesics and antagonists.

#### **Text Books:**

1. Tripathi, Essentials of Medical Pharmacology, Jaypee Brothers, Latest Edition
2. H.P Rang, M. M. Dale & J.M. Ritter, Pharmacology, Churchill Livingstone, 4<sup>th</sup> Ed.
3. David E. Golan, Armen H. Tashjian, April W. Armstrong, Principles of pharmacology, Latest edition
4. Bertram G. Katzung, Basic and clinical pharmacology, 9th Edn; Prentice Hall International
5. Sathoskar, Pharmacology and pharmacotherapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.

#### **Reference Books:**

1. J.G. Hardman and Lee E. Limbird, Goodman & Gilman, The Pharmacological basis of therapeutics, McGraw-Hill, Health Professions Divn.
2. J. Crossland, Lewis, Pharmacology, Churchill Livingstone.
3. Ruth Woodrow, Essentials of Pharmacology for Health Occupations. Delmar Cengage Learning



## **BPH 304: PHARMACEUTICAL MICROBIOLOGY**

**UNIT I Introduction to Microbiology:** Origin, scope and discovery of spontaneous generations theory, contributions of Antonie Van Leeuwenhoek, Pasteur, Koch and Lister. Diversity of Microorganisms: Prokaryotes versus eukaryotes – eukaryotic and prokaryotic cell structure, threedomains of life (bacteria, archaea and eukaryotes). Pharmaceutical significance of protozoa, algae, fungi, bacteria and viruses. Characterization and identification of microorganisms.

**UNIT II Nutrition and Growth of Microbes:** Nutritional requirements, Types of Nutrient

media and growth conditions and Nutritional types based on energy source. Isolation, cultivation (aerobic & anaerobic) and preservation of microorganisms, physiology of growth, bacterial growth curve, methods for determining bacterial numbers, mass and cell

constituents. Exponential growth and generation time. Bacterial growth in batch and continuous culture (chemostat and turbidostat) synchronous growth.

**UNIT III Control of Microorganisms:** General Concepts, Inhibition of growth and killing,

sterilization and disinfection, antisepsis and sanitation, mode of action application & limitation of physical agents (moist and dry heat, radiation and filtration), chemical agents. Various types of disinfectants, factors affecting sterilization and disinfection, evaluation of antimicrobial activity. Chemotherapeutic agents, mode of action and applications, drug resistance. Official methods of sterility testing of pharmaceuticals and biosafety measures.

### **UNIT IV**

**Epidemiology of Diseases:** Study of etiology, diagnosis, source of infection, mode of transmission, immunization methods, prevention and control of the following diseases. Bacillary dysentery, diphtheria, tuberculosis, leprosy, cholera, typhoid, syphilis, gonorrhoea, tetanus, food poisoning and infective hepatitis. Diagnostic tests of Malaria, Typhoid, Cholera, TB, Leprosy.

### **Application of Microbes in Pharmaceutical Industry**

**Microbiological Assays:** Principles and Methods involved in Assay of Antibiotics (penicillins, tetracyclines and streptomycins only) Vitamins (cyanocobalamin and riboflavin only), Amino acids (lysine and glutamic acid only) & Bio-Sensors in Analysis.

### **Text Books:**

1. Pelczar and Reid, Text Book of Microbiology Lippincott Williams & Wilkins, 2nd Edition.
2. Anantha Narayan and Jayram Panikar, Text Book of Microbiology, Orient Longman, Delhi, Hyderabad.
3. R.C. Dubey, A textbook of Microbiology S.Chand.

### **Reference Books:**

1. Pharmaceutical microbiology by Kishore Gujar, Himalaya publishing house.
2. Nester, Anderson, Roberts, Pearsall, Microbiology, McGraw-Hill.
3. Hugo. W B, Pharmaceutical Microbiology. PA Publishing Pvt. Ltd.
4. Tortora, Gerard, Text Book of Microbiology. Benjamin Cummings.
5. Prescott and Dunn, “Industrial Microbiology” 2nd Ed, Mc Graw hill Book Company Inc.

**BPH 305: DRUG STORE & INDUSTRIAL. MANAGMENT.& MARKETING****UNIT-1**

1. Drug Store Management: Selection of site, space, layout and legal requirements. Storage of drugs of various schedules and maintenance of records as per requirement. Hospital supplies, requirements for dispensing extemporaneous preparations. Importance and objectives of purchasing, selection of suppliers, credit information, tenders, contracts and price determination, removal of expired drugs. Patient counseling – maintenance of records.
2. Plant location and layout of an industry: Various factors affecting locational aspects, layout of building and equipment. Product layout versus process layout and compliance of pollution control measures.

**UNIT-2**

Production, planning and control – scientific purchasing, quality control, problems of productivity, stores organization, location of stores, receiving, inspection of materials and issue from the store, control of stores and stocks, stores accounting and records. Personnel management – selection, appointment, training, transfer, promotion, demotion policies, remuneration, job evaluation, human relations.

**UNIT-3**

Sales organization: Market, definition, different approaches to the study of marketing, institutional approach, market planning, product planning, method of marketing, wholesalers, retailers, functional approach, efficiency in marketing, commodity approach.

Distribution policies: Selective and Exclusive distribution, pricing and discount policies, credit policies, trade indication marks, patent policies. Sales promotion policies – detailing to physician, professional persons, sampling, window and interior display, product advertising, sales promotion publicity.

**UNIT-4**

Budgets and budgetary controls: Elements of accounting, double entry book keeping, books of accounts, trial balance, final accounts of business and profit, profit and loss accounts, appropriation accounts, balance sheets.

**Reference Books:**

1. Remington's Pharmaceutical Sciences.
2. Pharmaceutical marketing in India, concepts strategy cases by Subba Rao Chaganti Published by Pharma book syndicate.

**BPH 306: PHARMACEUTICAL TECHNOLOGY-II PRACTICALS****I. EXPERIMENTS:**

1. Manufacturing of tablets:
  - a. Ordinary compressed tablets by wet granulation.
  - b. Tablets prepared by direct compression
  - c. Soluble tablets/dispersible granules
  - d. Chewable tablets
  - e. Effervescent tablets.
2. Evaluation of tablets (Weight variation, hardness, friability, disintegration and dissolution)
3. Formulation and filling of hard gelatin capsules.
4. Parenterals:
  - a) Manufacturing of parenterals (Ampoule sealing (Pull sealing and tip sealing)
  - b) Evaluation of parenterals (Clarity test, and leaking test).

**II. DEMO/ WORKSHOP**

Coating of tablets (sugar/film/enteric)

**III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

1. Advances in granulation technology.
2. Multifunctional excipients.
3. Excipients and their commercial names.

## **BPH 307: MEDICINAL CHEMISTRY-I PRACTICALS**

### **I. EXPERIMENTS**

1. Synthesis of Barbituric acid from Diethyl Malonate
2. Synthesis of Phenytion from Benzoin or Benzil
3. Synthesis of Diphenyl quinoxaline from o-phenylene diamine and benzil
4. Synthesis of phenothiazine from o-phenylene diamine
5. Synthesis of Benzocaine from Para amino benzoic acid
6. Synthesis of Dibromo succinic acid from malic acid
7. Synthesis of Benzoxazine from Anthranilic acid
8. Monograph analysis of Caffeine
9. Monograph analysis of Phenytion
10. Monograph analysis of Barbituric acid
11. Monograph analysis of Benzocaine
12. Monograph analysis of Lignocaine gel

(Literature, Journal reported lead compounds synthesis relevant to theory can also be included)

### **II Demo/Workshop**

1. Stereo models of some drugs relevant to theory.
2. Extraction of drugs from different dosage forms

### **III Seminar/Assignment/Group discussion**

Photochemistry as a green synthetic method, novel methods for the separation of optical isomers, highly selective metalation reactions, high throughput screening, combinatorial chemistry, In silico drug design.

### **References:**

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition. Pearson Prentice Hall.
2. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, 4th Edition. Pearson Publishers.

### **LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Water bath
2. Suction pumps
3. Analytical/physical balance
4. Triple beam balance
5. Reflux flask with condenser
6. Hot plates
7. Refrigerator
8. Mechanical and magnetic stirrer with thermostat
9. Distillation unit
10. Oven
11. Adequate glass wares

**BPH 308: PHARMACEUTICAL MICROBIOLOGY PRACTICALS****I. EXPERIMENTS:**

- 1 Introduction to equipment and glassware used in microbiology laboratory.
- 2 Preparation of various culture media.
- 3 Sterilization techniques and their validations.
- 4 Aseptic transfer of culture into different types of media.
- 5 Characterization of microbes by staining methods (simple gram's, acid fast and negative staining and spore staining) and motility testing by hanging drop method.
- 6 Enumeration of bacteria by pour plate/spread plate technique
- 7 Enumeration of bacteria by direct microscopic count.(Neubauer's chamber)
- 8 Isolation of pure cultures by streak plate, spread plate and pour plate.
- 9 Evaluation of antiseptics and disinfectants by phenol coefficient method(R/w),
- 10 Sterility test for bulk powders and water for injection (IP).
- 11 Observation of colony/culture characters
- 12 Bio chemical reactions:
  - i) Indole test.
  - ii) Methyl red test.
  - iii) Voges proskauer test.
  - iv) Starch hydrolysis test.
  - v) Fermentation of carbohydrates and gelatin liquefaction.
- 13 Anti-microbial assay by cup and plate method and turbidometric method

**II. Demonstration/Workshop:** Construction of Bacterial growth curve by different methods, Rapid Diagnostic tests by kits

**III. Assignment/Seminar/Group discussion:**

Recent trends in Identification, Cultivation, Handling of Microorganisms. Polymer Chain Reaction (PCR).

### **III B.PHARM- II SEMESTER**

#### **BPH 309: MEDICINAL CHEMISTRY-II**

##### **UNIT I        Drugs acting on renal system**

**Renin-Angiotensin system inhibitors:** Captopril\*, Lisinopril, Enalapril\*, Ramipril, Benzapril, Losartan\*, Candesartan, Telmisartan, Valsartan, Aliskiren.

**Diuretics:** Acetazolamide\*, Methazolamide, Dichlorphenamide, Hydrochlorthiazide\*, Benzthiazide, Furosemide\*, bumetanide, Newer- Piretanide, Ethacrynic acid\*, Indacrinone, Spironolactone, Aldosterone, Amiloride, Triamterene and Mannitol. SAR- Carbonic anhydrase inhibitors, Thiazides, Loop diuretics, Phenoxy acetic acid derivatives.

##### **UNIT II        Drugs acting on CVS**

**Anti anginal agents & vasodilators:** Nitroglycerin, Isosorbide dinitrate, Erithrityl tetranitrate\*, pentaerythritol tetranitrate. **Ion channel blockers-** Verapamil, Diltiazem, Nifedipine, Amlodipine\*, Felodipine, Nicardipine, Bepridil, Ranolazine.

**Antithrombotic agents-** Aspirin, Dipyridamole, Clopidogrel\* and Ticlopidine

**Antiarrhythmic drugs:** Quinidine, Procainamide\*, Disopyramide, Lidocaine, Mexiletine\*, Propafenone, Amiodarone, Bretylium, Sotalol.

**Antihypertensive agents:** classification, Reserpine, Guanethidine, Prazosin, Terazosin, Methyldopa, Clonidine, Hydralazine, Sodium nitroprusside, Sildenafil citrate, Minoxidil, Amrinone, Milrinone. SAR- beta-blockers

**Antihyperlipidemic agents:** Clofibrate, Fenofibrate\*, Dextrothyroxine, Cholestyramine resin, Colestipol, Nicotinic acid,  $\beta$ -Sitosterol, Probucol, Ezetimibe, Simvastatin\*, Lovastatin, Pravastatin, Fluvastatin, Atorvastatin, Rosuvastatin. SAR- HMG CO-A inhibitors

##### **UNIT III Drugs acting on Blood, hypoglycemic agents and**

**thyroid. Anticoagulants:** Factors, Warfarin sodium\*, Dicumarol, Anisindione

**Synthetic hypoglycemic agents:** Tolbutamide\*, Tolazamide, Chlorpropamide, Acetohexamide, Glipizide, Glyburide, Glimepiride, Gliclazide, Repaglinide, Pioglitazone, Metformin\*, Acarbose, Miglitol.

**Thyroid and antithyroid drugs:** Levothyroxine, Liothyronine, Propylthiouracil, Methimazole.

##### **UNIT IV        Analgesic, antipyretic and anti-inflammatory agents**

**Opioids:** Levorphanol, Dextromethorphan, Pentazocine, Meperidine, Loperamide, Fentanyl,

Methadone, Tramadol\*, Butorphanol, Buprenorphine. **Opioid antagonist:** Naltrexone, Naloxane, Methylnaltrexone.

**NSAIDs:** A note on prostaglandins and leukotrienes. Aspirin, Indomethacin, Sulindac\*, Tolmetin, Ketorolac, Ibuprofen\*, Naproxen, Fenoprofen, Mefenamic acid, Diclofenac\*, Lumiracoxib, Piroxicam, Meloxicam, Celecoxib, Paracetamol\*.

**Management of Gout and Hyperuricemia:** Colchicine, Allopurinol\*, Probenecid, Sulfinpyrazole. **Antimigraine drugs:** Sumatriptan, Zolmitriptan. SAR – Salicylates, Aryl propionic acids, oxicams.

**Antibiotics**

**β- Lactams:** Penicillin G, Penicillin V, Methicillin, Oxacillin, Cloxacillin\*, Dicloxacillin,

Ampicillin\*, Amoxicillin, piperacillin. β- Lactamase inhibitors: Clavulanate potassium, Sulbactam, Tazobactam, Newer-Meropenem, Biapenem, Cephalosporins: Cephalexin\*,

**Aminoglycosides and Tetracyclines:** Streptomycin, Neomycin, Kenamycin, Amikacin, Gentamicin, Tobramycin, Tetracycline, Chlortetracycline, oxytetracycline, Doxycycline, Minocycline. SAR-Aminoglycosides and tetracyclines.

#### **Text Books:**

1. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.
2. An Introduction to Medicinal Chemistry by Graham. L. Patrick, Oxford University publishers.
3. JH Block & JM Beale (Eds), Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcolt, Raven, Philadelphia, 2004
4. Rama Rao Nadendla, Medicinal Chemistry; Mc Millan Publishers.

#### **Reference Books:**

1. Hansch, Comprehensive medicinal chemistry, Vol 1 – 6 Elsevier pergmon press, Oxford
2. D. Abraham (Ed), Burger Medicinal chemistry ad Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6<sup>th</sup> Ed.
3. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Ed: I.Oxford University Press, Delhi.
4. Daniel lednicer, Strategies for Organic Drug Synthesis and Design, John Wiley, N. Y. 1998.  
D. Lednicer, Organic drug synthesis, Vol, 1 – 6, J.Wiley N.Y.

## **BPH 310: PHARMACOLOGY-II**

### **UNIT I Drugs acting on cardiovascular System**

- a. Pharmacology of drugs used in hypertension and CHF
- b. Pharmacology of drugs used in coronary artery diseases (Atherosclerosis, Angina and MI)
- c. Pharmacology of drugs used in arrhythmias
- d. Shock and treatment of different types of shock

### **UNIT II Drugs acting on hematopoietic system**

- a. Coagulants, anticoagulants
- b. Fibrinolytics, anti fibrinolytics, anti platelet drugs
- c. Haematinics and plasma expanders

### **UNIT III**

#### **a. Drugs acting on urinary system**

- i) Fluid and electrolyte balance
- ii) Diuretics and anti diuretics

#### **b. Drugs acting on respiratory system**

- i) Antiasthmatics including bronchodilators
- ii) Antitussives and expectorants
- iii) respiratory stimulants

### **UNIT IV Autacoids**

- a. Amine autacoids- Histamine, 5-HT and their antagonists
- b. Lipid derived autacoids-Prostaglandins, thromboxanes and leukotrienes.
- c. Peptide autacoids- Angiotensin, bradykinin

### **Hormones and hormone antagonists**

- a. Insulin, Oral hypoglycemic agents
- b. Thyroid and antithyroid drugs
- c. Adrenocortical steroids and their analogues
- d. Uterine stimulants and relaxants
- e. Oestrogens, progesterones, androgens, anabolic steroids and oral contraceptives

### **Text Books:**

1. Tripathi, Essentials of Medical Pharmacology, Jaypee Brothers, Latest Edition
2. H.P Rang, M. M. Dale & J.M. Ritter, Pharmacology, Churchill Livingstone, 4<sup>th</sup> Ed.
3. David E. Golan, Armen H. Tashjian, April W. Armstrong, Principles of pharmacology, Latest edition
4. Bertram G. Katzung, Basic and clinical pharmacology, 9th Edn; Prentice Hall International

### **Reference Books:**

1. Sathoskar, Pharmacology and pharmacotherapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.
2. J.G. Hardman and Lee E. Limbird, Goodman & Gilman, The Pharmacological basis of therapeutics, McGraw-Hill, Health Professions Division.
3. J. Crossland, Lewis, Pharmacology, Churchill Livingstone.
4. Ruth Woodrow, Essentials of Pharmacology for Health Occupations. Delmar Cengage Learning



## BPH 311: PHARMACEUTICAL ANALYSIS II

### UNIT I

**UV and Visible Spectroscopy:** EMR, Molecular energy, types of electronic transition during UV-Visible light absorption, Beer-Lambert's law & deviations, chromophores, Auxochromes, isobestic point, instrumentation – Construction of single beam and double beam spectrophotometers, Woodward's Fiesher rules for calculation of  $\lambda_{\text{max}}$ , quantitative applications (calibration method,  $A1\%1\text{cm}$ , single and double point standardization, simultaneous equation method) to dosage forms.

**IR Spectroscopy:** Vibrational energy in bond, types of vibrations, Hook's law, sample preparation, instrumentation – FT-IR (single and double beam), ATR, determination of functional group by IR spectra, Application of IR spectra in monograph analysis as per IP. Note on "mutual exclusion principle".

### UNIT II

**$^1\text{H}$ -NMR spectroscopy:** Principle, theory, spin-quantum number, energy levels, relaxation process, chemical shift and NMR spectrum, shielding and de-shielding, spin-spin coupling, J – value, Instrumentation, applications, ESR Vs NMR (comparison of principle and application).

**Mass Spectrometry:** Basic principle, types of peaks in mass spectrum, fragmentation pattern, instrumentation (single and double focusing), ionization techniques, Nitrogen rule, unsaturation index (formula).

### UNIT III

**Fluorimetry:** Theory, Fluorescence and chemical structure, Stokes and anti-Stokes, quantum efficiency, factors affecting the intensity of fluorescence, Instrumentation (double beam), Applications in Pharmaceutical analysis.

**Flame Emission photometry Vs Atomic absorption spectroscopy:** Emission spectra, Absorption spectra, line spectra, principle of absorption / emission of UV light by elements, instrumentation, applications in pharmaceutical analysis. Focus on interference.

**Nephelo-turbidimetry:** Introduction, principle, instrumentation of Nephelo-turbidimeter, pharmaceutical application as specified in IP, determination chlorides and sulphates.

### UNIT IV

- ☐ Principle of optical activity, optical purity, concept of Optical Rotatory dispersion (ORD), Octant Rule, Circular dichroism Vs ORD.
- ☐ XRD: production X-ray, types, Bragg's law, XRD pattern in identification and comparison of polymorphs with examples.
- ☐ Radio Immuno Assay & Enzyme Linked Immuno Sorbate Assay : principle, Procedure and application in diagnosis.

**Gas Chromatography:** Principle, adsorption isotherm and its relation to tailing and fronting, Instrumentation - carrier gas, flow regulators, injectors columns, detectors. Various parameters used in GC analysis.

**HPLC:** Principle, Van Deemter equation, Instrumentation - mobile phase, degassing, pumps, injectors, columns, detectors. Isocratic and gradient elution in RP-HPLC.

### Text Books:

1. R.M. Silverstein and G.C. Bassler, Spectrometric Identification of Organic Compounds. John Wiley & Sons.

2. AH Beckett & Stenlake, Text book of Practical Pharmaceutical chemistry, Vol.II Continuum International Publishing Group, Althone.
3. Robert D. Braun, Introduction to Instrumental Analysis. Pharma Med Press.
4. Skoog, West and Holler Principles of Instrumental Analysis; Saunders college Publishing, London.
5. William Kemp. Organic spectroscopy, wiley edition

**Reference Books:**

1. Hobart. H. Willard and others, Instrumental methods of analysis, CBS publishers and Distributors New Delhi.
2. Settle, Handbook of Instrumental Techniques for Analytical Chemistry. Prentice Hall.
3. P.D. Sethi, Quantitative analysis of Drugs and Pharmaceuticals. CBS Publishers.
4. K. A. Connors, A Textbook of pharmaceutical analysis, Wiley Interscience, NY.
5. Pharmacopoeia (IP, BP, USP).
6. B.K. Sharma, Instrumental Chemical Analysis, Goel Publishers.

**BPH 312 A: FORENSIC PHARMACY****UNIT-1**

Evolution of pharmacy and drug legislation in India. A study of the following acts with upto date amendments.

- a) Pharmacy Act
- b) Drugs and Cosmetic Act and Rules

**UNIT-2**

- c) Narcotic Drugs and Psychotropic Substances Act (1986)
- d) Drugs and Magic Remedies Act

**UNIT-3**

- e) Drugs (Price Control) Order
- f) Medicinal and Toilet Preparations (Excise duties) Act and Rules.

**UNIT-4**

- g) Patents Act and Intellectual Property Rights
- h) Medical Termination of Pregnancy Act
- i) Code of Pharmaceutical Ethics

**Reference Books**

1. Original Laws Published by Government of India.
2. Forensic Pharmacy by B.M. Mithal
3. Laws of drugs in India – Hussain
4. Intellectual Property Law by R.K. Nagarajan
5. Text book of forensic pharmacy by C.K.Kokate and S.B.Gokhale published by Pharma book syndicate.

## **BPH 312 B: CLINICAL TRIALS**

### **UNIT I**

Introduction to drug discovery and drug development

Drugs, Preclinical studies, Pharmacodynamics, Pharmacokinetics, Drug interactions, Introduction to Pharmacoeconomics.

### **UNIT II**

Ethics committee and its member, Institutional ethics committee, Role of ethics committee for approval of protocols.

### **UNIT III**

Preclinical toxicology, Systemic toxicology, Carcinogenicity, Mutagenicity, Teratogenicity, Reproductive toxicity, Local toxicity, Genotoxicity.

### **UNIT IV**

Clinical trials, Phase I, II, III, IV

Types of Clinical trials, Single blinding, Double blinding, Open access, Randomized trials, Cross over design, Data management in clinical research.

New drug Discovery, NDA, INDA.

Text Books:

1. Tripathi, Essentials of Medical Pharmacology, Jaypee Brothers, Latest Edition
2. H.P Rang, M. M. Dale & J.M. Ritter, Pharmacology, Churchill Livingstone, 4<sup>th</sup> Ed.
3. David E. Golan, Armen H. Tashjian, April W. Armstrong, Principles of pharmacology, Latest edition
4. Bertram G. Katzung, Basic and clinical pharmacology, 9th Edn; Prentice Hall International

#### **Reference Books:**

5. Sathoskar, Pharmacology and pharmacotherapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.
  6. J.G. Hardman and Lee E. Limbard, Goodman & Gilman, The Pharmacological basis of therapeutics, McGraw-Hill, Health Professions Division.
  7. J. Crossland, Lewis, Pharmacology, Churchill Livingstone.
- Ruth Woodrow, Essentials of Pharmacology for Health Occupations. Delmar Cengage Learning

**BPH 312 C: INDUSTRIAL.PHARMACY & COSMETIC TECHNOLOGY****UNIT-1**

1.Pre – formulation: Objectives – Protocols – Physical, chemical, Micromeritic studies in pre – formulation, stability considerations, drug – excipient compatibility.

2.Formulation Development : Factors involved,

- I. Case studies: Formulation of (i) An antacid product (ii) An ampicillin product for Paediatric use (iii) An antibacterial product for a child (iv) Pain balm (v) An anti-inflammatory gel.

**UNIT-2**

II. A study of the formulation, process and equipment used in the large scale manufacture, evaluation, and quality control of the following dosage forms.

- (i) Suspensions (ii) Emulsions (iii) Liquid orals (Syrups and Elixirs).  
i. Tablets , Tablet Coating – sugar, film and enteric coating  
ii. Capsules – hard and soft.

**UNIT-3**

- (i) Parenterals , Other sterile products – eye ointments, eye drops.  
(ii) Sustained release products , Microencapsulation and microcapsules  
(iii) Aerosol preparations

**UNIT-4**

Formulation and preparation of the following Cosmetics – Hand lotions and creams, face powders, baby and bath powders, dentifrices, shampoo, lipstick, shaving preparations and hair dyes and creams, skin creams.

**BPH 313: MEDICINAL CHEMISTRY-II PRACTICALS****I. EXPERIMENTS:**

1. Synthesis of Paracetamol from p-amino phenol
2. Synthesis of Cinnamic acid from benzaldehyde
3. Synthesis of Benzotriazole from o-phenylene diamine
4. Synthesis of 1-phenyl-3-methyl-5-pyrazolone from hydrazine hydrate
5. Synthesis of 7-Hydroxy-4-methyl coumarin from resorcinol and ethyl acetoacetate
6. Synthesis of Salicylaldehyde from phenol
7. Synthesis of Aspirin from salicylic acid
8. Identification and test for purity for Aspirin tablet as per IP
9. Identification and test for purity for Acetazolamide tablet as per IP
10. Identification and test for purity for propranolol tablet as per IP
11. Identification and test for purity for Diclofenac sodium tablet as per IP
12. Identification and test for purity for Paracetamol tablet as per IP

**II. DEMO/WORKSHOP:**

Microwave assisted organic synthesis, Purification of synthesized compounds (Column chromatography)

**III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

Antibiotic discovery in the twenty-first century: Current trends and future perspectives, Current Trends in  $\beta$ -Lactam based  $\beta$ -Lactamase inhibitors and CVS agents.

**References:**

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5<sup>th</sup> Edition. Pearson, Prentice Hall.
2. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, 4<sup>th</sup> Edition, Pearson Publishers.

**LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Water bath
2. Suction pumps
3. Analytical/physical balance
4. Triple beam balance
5. Reflux flask with condenser
6. Hot plates
7. Refrigerator
8. Mechanical and magnetic stirrer with thermostat
9. Distillation unit
10. Oven
11. Adequate glass wares

## **BPH 314: PHARMACOLOGY-II PRACTICALS**

### **I. EXPERIMENTAL PART ( To use appropriate softwares for animal experimentation)**

#### **1. Introduction to Experimental Pharmacology**

Preparation of different solutions for experiments.

Drug dilutions, use of molar and % w/v solutions in experimental Pharmacology.

Common laboratory animals and anaesthetics used in animal studies.

Commonly used instruments in experimental pharmacology.

Different routes of administration in animals

Collection of blood samples from animals

2. Study the effect of autonomic drugs on rabbit's eye

3. Record the concentration response curve (CRC) of acetylcholine using rectus abdominus muscle preparation of frog.

4. Record the CRC of 5-HT on rat fundus preparation.

5. Record the CRC of histamine on guinea pig ileum preparation.

6. To study the inotropic and chronotropic effects of drugs on isolated frog heart.

7. To study the effects of various agonists and antagonists and their characterisation using isolated preparations like frog's rectus abdominus muscle and isolated ileum preparation of rat & guinea pig.

### **II. DEMO/ WORK SHOP**

Arterial and venous cannulations, organ isolation and its application in research.

### **III. SEMINAR/ ASSIGNMENT/ GROUP DISCUSSION**

1. Isolation, characterization and nomenclature of receptors.

2. Metabolic disorders and their complications

3. Novel targets for the treatment of various disorders

#### **References:**

1. Practicals in pharmacology By Dr.R.K.Goyal

2. Handbook of experimental pharmacology By S.K.Kulakarni

3. Experimental pharmacology By M.N.Ghosh

4. EXPO – Experimental pharmacology software.

## **BPH 315: PHARMACEUTICAL. ANALYSIS II PRACTICALS**

### **I. EXPERIMENTS**

1. Determination of  $\lambda$ - max of  $\text{KMnO}_4$  (Visible)
2. Determination of  $\lambda$ - max of ciprofloxacin (any one drug) (UV)
3. Determination of isobestic point of any 2 drugs.
4. Assay of Riboflavin-Colorimetric method.
5. Assay of Ibuprofen (any one drug)-UV-spectro photometry-calibration curve method.
6. Assay of Paracetamol-UV-spectro photometry-A(1%,1cm) method
7. Assay of Thiamine by Fluorimetry.
8. Study of quenching effect of quinine by Fluorimetry.
9. Determination of Na/K ions by Flame photometry.
10. Determination of sulphates in calcium gluconate by Nepheloturbidometry.
11. Interpretation of UV and IR Spectra.
12. Interpretation of NMR and Mass Spectra.

### **II. DEMO/WORK SHOP**

1. Demonstration of HPLC, determination of any drug, selection of solvent, mobile phase, stationary phase, and optimization of chromatographic conditions.
2. Demonstration of GC, determination of any drug, selection of solvent, mobile phase, stationary phase, and optimization of chromatographic conditions.
3. Demonstration of gel electrophoresis.

### **III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

Determination of two drugs simultaneously by using UV spectrophotometer. criteria in selection of mobile phase, stationary phase & detector in HPLC.

### **LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Fluorimeter
2. UV-Spectrophotometer
3. TLC kits
4. Electrophoresis equipment
5. Digital balance
6. Chromatographic columns
7. Colorimeter
8. KF titrator
9. Adequate glasswares



## **IV B.PHARM- I SEMESTER**

### **BPH 401: MEDICINAL CHEMISTRY-III**

#### **UNIT I**

Histamine and Antihistaminic agents- H1-Antagonists: Chlorpheniramine\*, Triprolidine, Phenindamine, Diphenhydramine\*, Doxylamine succinate, Tripeleminamine, Antazoline phosphate, Cyclizine, Meclizine\*, Buclizine, Promethazine\*, Methdilazine, Cyproheptadine, Azatadine maleate, Fexofenadine, Loratadine, Desloratadine, Cetirizine, Acrivastin, H2 Antagonists: Cimetidine, Famotidine, Ranitidine\*, Omeprazole\*, Esomeprazole, Lansoprazole, Pantoprazole, Rabeprazole, Sucralfate, Misoprostol. Note on H3-Agonist and antagonists. SAR – H1 and H2 receptor antagonists.

#### **UNIT II**

Synthetic antibacterials and antifungal agents Sulphonamides and quinolones: Cotrimaxazole, Sulphacetamide\*, Sulphaquanidine, sulfisoxazole\*, sulfadoxime, trisulfapyrimidines, triple sulfa, Norfloxacin, Ciprofloxacin, Ofloxacin\*, Levofloxacin. SAR- Sulphonamides, Fluroquinolones. Urinary antiseptics: Nitrofurantoin\*, Furazolidine, Nitrofurazole, Methenamine. Antifungal agents: Clotrimazole\*, Itraconazole, Ketoconazole, Miconazole\*, Fluconazole, Amphotericin B, Nystatin, Griseofulvin\*. SAR- azoles.

#### **UNIT III**

Anti-parasitic and antimycobacterial agents Antimalarials: Life cycle, Chloroquine\*, Amodiaquine, Primaquine, Quinacrine\*, Artemisinin, Pyrimethamine, Atovaquone and Proguanil. SAR – 4 -aminoquinolines, Aminoacridines. Antiamoebics and anthelmintics: Metronidazole, Tinidazole\*, Diloxanide, Iodoquinol, DEC\*, Thiabendazole, Piperazine, Mebendazole\*, Albendazole, Dimercaprol, Niclosamide, Pyrantel Pamoate, Ivermectin. SAR- Azole Antimycobacterials: Isoniazid\*, Ethambutol\*, Pyrazinamide, Rifampicin, Thioacetazone, 4-Asa Cycloserins, Dapsone\*, Clofazimine.

#### **UNIT IV**

Antiviral and antineoplastic agents Antiviral: Viral replication, Amantidine\*, Acyclovir\*, Oseltamivir, Idoxuridine, Zidovudine\*, Lamivudine, Stavudine, Efavirenz, Didanosine, Tenofovir, Zalcitabine, Emtricitabine, Nevirapine, Ritonavir, Saquinavir. SAR- RTIs, NNRTIs. Antineoplastic: Chlorambucil\*, Cyclophosphamide, Ifosfamide, Thiopeta, Lomustine, Busulfan, Carmustine\*, Cisplatin, Procarbazine, Streptozocin, Methotrexate, 5-FU, Cytarabine, 6-MP, Thioguanine, Vidarabine, Tamoxifen. Chemistry of anticancer antibiotics, A note on Newer agents. SAR – Alkylating agents, Nitro ureas, Antimetabolites.

Basic concepts of Drug Design and discovery Concept on ligand, targets, lead molecules, Pharmacophore. Basis of structure based and ligand based drug design, note on Combinatorial chemistry, SAR, QSAR.

**NOTE:** Introduction, definition, chemical classification with structure, nomenclature, synthesis (only for \* marked drugs), mechanism of action, SAR including stereochemical aspects, metabolites (including its ADR) and therapeutic uses of the following classes of drugs from UNIT I to UNIT IV.

**Text Books:**

1. JH Block & JM Beale (Eds), Wilson & Giswold's Text book of organic Medicinal Chemistry and pharmaceutical chemistry, 11th Ed, Lipcolt, Raven, Philadelphia, 2004
2. William O. Foye, Textbook of Medicinal Chemistry, Lea Febiger, Philadelphia.
3. An Introduction to Medicinal Chemistry by Graham. L. Patrick, Oxford University publishers.
4. Rama Rao Nadendla, Medicinal Chemistry; Mc Millan Publishers.

**Reference Books:**

1. Hansch, Comprehensive medicinal chemistry, Vol:1–6 Elsevier pergmon press, Oxford.
2. D. Abraham (Ed), Burger Medicinal chemistry ad Drug discovery, Vol. 1 & 2. John Wiley & Sons, New York 2003, 6th Ed.
3. M. Atherden, Bentley and Driver's Textbook of Pharmaceutical Chemistry Ed: 1.Oxford University Press, Delhi.
4. Daniel lednicer, Strategies for Organic Drug Synthesis and Design

## **BPH 402: PHARMACOLOGY-III**

### **UNIT I**

#### **Drugs acting on the gastrointestinal tract**

- a. Anti-ulcers Drugs
- b. Laxatives and anti-diarrhoeal drugs
- c. Emetics and anti-emetics
- d. Appetite Stimulants and Suppressants

### **UNIT II**

#### **Chemotherapeutic agents and their applications**

- a. General principles of chemotherapy.
- b. Sulphonamides, co-trimoxazole and  $\beta$ -lactam antibiotics
- c. Tetracyclines, aminoglycosides, chloramphenicol, macrolides, quinolones, fluoroquinolones and polypeptide antibiotics

### **UNIT III**

- a. Chemotherapy of tuberculosis & leprosy
- b. Chemotherapy of malignancy and immunosuppressive agents.

### **UNIT IV**

- a. Chemotherapy of fungal and viral diseases
- b. Chemotherapy of protozoal diseases and helminthic infections

#### **Principles of toxicology & Principles of bioassays.**

- a. Definition of poison, general principles of treatment of poisoning
- b. Treatment of barbiturate, opiod, organophosphorous and atropine poisoning.
- c. Heavy metals and heavy metal antagonisits. LD<sub>50</sub>, ED<sub>50</sub> and therapeutic index
- d. Principles of bioassays and errors in bioassys.
  - d. Study of bioassay methods for the following drugs
    - i. Digitalis ii. d-tubocurarine, iii. Oxytocin iv. Insulin v. HCV

#### **(a) Text Books:**

1. H.P Rang, M. M. dale & J.M. Ritter, Pharmacology, Churchill living stone, 4<sup>th</sup> Ed.
2. J.G. Hardman and Lee E. Limbard, Good Mann & Gilmann, The Pharmacological basis of therapeutics, Mc Grawhill, Health Professions Dvn.
3. Illiterated Pharmacology by Lippincotts

#### **(b) REFERENCES**

1. Tripathi, Essentials of Medical Pharmacology, Jaypee Brother's, Latest Edition
2. Sathoskar, Pharmacology and pharmaco therapeutics Vol. 1 & 2, Publ by Popular Prakashan, Mumbai.

### **BPH 403: PHARMACOGNOSY-III**

#### **UNIT I**

**A) Phytochemical Screening:** Preparation of extracts, screening of alkaloids, saponins, cardiac glycosides, flavonoids, tannins and anthraquinones in plant extracts. Identification and estimation of various phytoconstituents.

**B) Plant tissue culture:** History, types, media requirements, methodology for establishment of cell cultures; growth measurements, viability measurements and applications. Micropropagation, immobilization, hairy root culture.

#### **UNIT II**

Introduction, classification and study of different chromatographic methods and their applications in evaluation of crude drugs. Concept of finger printing and marker compound analysis.

#### **UNIT III**

A) Study of traditional drugs – common and vernacular names, sources, chemical constituents and uses of Kantakari, Malkanguni, Shatavari, Tylophora, Bilva, Kalijeeri, Rasna, Aparmarga, Gokhuru, Guduchi, Bach, Amla, Guggul, Kalimusali, Punarnava, Chirata and Brahmi.

B) General introduction to Indian Systems of Medicine like Ayurveda, Siddha, Unani and Homeopathy.

C) Methods of preparation of formulations in Ayurveda like churnas, lehyas, tailas, asavas and aristas.

#### **UNIT IV**

A) General introduction to cosmeceuticals, role of herbs in cosmetics. Study of the following cosmeceuticals - Amla, Henna, Cyperus, SoapNut, AloeVera, Turmeric, Sandal Wood and Bitter Orange Peel.

B) Definition and study of Nutraceuticals: Garlic, Spirulina, Soya and Royaljelly.

C) Introduction and importance of trade in herbal medicine, herbal cosmetics and Indian herbal drug industry.

D) Natural dyes and their applications in pharmacy.

E) Study of mineral drugs- Bentonite, Kaolin, Keiselghur and Talc

F) Study of natural products from natural sources

#### **TextBooks:**

1. Kokate CK, Purohit A.P. & Gokhale; Pharmacognosy Nirali Prakashan, New Delhi.
2. Textbook of Pharmacognosy by Handa and Kapoor.
4. Pharmacognosy by Robert, Tyler.

#### **ReferenceBooks:**

1. WHO guidelines on good agricultural and collection practices (GACP)-WHO, Geneva
2. Cultivation & utilization of medicinal plants by Atal CR and Kapoor BM.
3. Textbook of Pharmacognosy by Wallis.
4. Pharmacognosy by Trease and Evans, latest edition.
5. USP, IP and BP. Ayurvedic Pharmacopoeia of India.
6. Ayurvedic Pharmacopoeia of India, Published by Govt of India.
7. Herbal Drug Industry by Eastern Publishers.
8. Peach Kand Tracey MV, Modern methods of Plant analysis, Narose publishing house, New Delhi
9. Ayurvedic Formulary of India, Govt of India Publication.
10. The Wealth of India, All volumes, CSIR, New Delhi.
11. Harbone JB; Phytochemical methods, Chapman and Hall.
12. Plant Tissue culture By Razdan

## **BPH 404: BIOPHARMACEUTICS & PHARMACOKINETICS**

### **UNIT – I**

Biopharmaceutics, Pharmacokinetics and Pharmacodynamics. Structure of GI membrane. Routes of drug administration and absorption from different routes.

**Drug Absorption.** Mechanisms of GI absorption, physico-chemical, biological and dosage form factors influencing absorption.

**Drug distribution.** Factors affecting drug distribution, physiological barriers of drug diffusion, apparent volume of distribution, drug binding to blood, tissues, protein binding – factors affecting, significance and kinetics of protein binding.

### **UNIT – II**

**Drug Metabolism:** Pathways of drug metabolism. Phase-I (oxidative, reductive and hydrolytic reactions). Phase II reactions (conjugation) Enzyme induction and inhibition, hepatic clearance, pharmacological activity of metabolites, first pass effect.

**Drug excretion.** Glomerular filtration, tubular secretion and reabsorption, effect of pH and other drugs. Clearance concept, excretion through bile, feces, lungs and skin in brief.

### **UNIT – III**

**Bioavailability and bioequivalence:** concept of equivalents, Definitions of various types of equivalents, types of Bioavailability studies, measurement of Bioavailability, plasma level and urinary excretion studies. Bioequivalence study design, IVIVC.

### **UNIT – IV**

**Pharmacokinetics.** Basic considerations, compartment modeling, one compartment open model - i.v. bolus and extra vascular administration, urinary excretion studies. Apparent volume of distribution, elimination rate constant, biological half life, area under the curve and clearance. Calculation of pharmacokinetic parameters. Method of residuals, Wagner and Nelson method, excretion rate method, sigma minus method. Solving of simple problems

**Nonlinear kinetics.** Non compartmental models, reasons for non linearity, concepts of linearity and non linearity, Michaelis- Menten equation and its significance.

### **Text Books:**

1. L. Shargel and ABC Yu, textbook of applied biopharmaceutics & Pharmacokinetics, 4th edn, Appleton – century – crofts, Connecticut, 2004.
3. Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics 4/Edn. Pharma Book Syndicate. Hyderabad.
4. DM Brahmkar and SB Jaiswal, biopharmaceutics and pharmacokinetics- a treatise, Vallabh Prakasham, Delhi.

### **Reference Books:**

1. Ronald & Trueter. Clinical pharmacokinetics concepts & applications. 3rd ed, Wolterskluwer Pvt Ltd., 2007.
2. Robert E Notary, Biopharmaceutics and pharmacokinetics – an introduction, Marcel Dekker Inc., NY
3. Basic pharmacokinetics by Hedaya, CRC Press

## **BPH 405A: CHEMISTRY OF NATURAL PRODUCTS**

### **UNIT I**

**General structural elucidation of natural products** General extraction procedure for various phytoconstituents, techniques in identification for alkaloids, glycosides, steroids, terpenes, flavonoids, phenols, lignans, resins, carbohydrate and proteins. Chemical methods for determination of active hydrogen, methoxy, hydroxyl, N-methyl and degradation (Hoffmann, Edmann etc) techniques for the determination of ring size. Structural elucidation of Ephedrine, Atropine, Morphine, Papaverine.

### **UNIT II**

**Alkaloids** Definition of alkaloids, pseudoalkaloids and protoalkaloids. General methods of extraction, isolation, Properties and tests for alkaloids.

**Opium alkaloids:** Structural features of Morphine molecule – Peripheral groups. Modification of structure and effect on analgesic activity – SAR of morphine and morphine-like analgesics.

**Narcotic antagonists:** Nalorphine, Levallorphan. Anti-tussive agents: Noscapine, Dextromethorphan. Smooth muscle relaxants: Papaverine and related compounds like ethaverine, Dioxylone. Structures and uses of these compounds.

**Tropane alkaloids:** Structures of Atropine/hyoscyamine, Hyoscyne, Hydrolytic products of these – Tropine and Scopine. Relationship between tropine & pseudotropine. Biological actions and uses of tropane alkaloids. Homatropine.

**Rauwolfia alkaloids:** Structures and uses of Reserpine, Rescinnamine, Deserpidine, ajmaline, syrosingapine. Hydrolysis of reserpine and rescinnamine. Mechanism of action of reserpine.

**Ergot alkaloids:** Classification, structures, hydrolytic products, pharmacological actions, therapeutic uses and toxicity. Synthetic derivatives: Methyl ergonovine (Methyl ergometrine), LSD, Ethysergide.

### **UNIT III**

**Terpenes & Terpenoids:** Introduction to Volatile oils, terpene vs terpenoids, Classification, isoprene, special isoprene and gemdialkyl rules. Sources and structures (Including isomerism), general extraction procedure and Pharmaceutical uses for Citral, citral-a (Geranial), citral-b (Neral). Alpha-terpeniol, Carvone, Menthol, Menthone, 1,8Cineole, Camphor. Chemical transformation and interconversion of citral to citronellal, citronellol, geraniol, nerol, geranic acid, p-cymene, alfa-terpeneol and ionones. Conversion and interconversion of camphor into camphoric acid, camphoronic acids, p-cymene, Borneol, isoborneol.

### **UNIT IV**

**Steroids:** Introduction, nomenclature and classification of steroids. Stereochemistry of Cholesterol. Structure and uses of Bile acids, steroidal hormones. Different Sources of steroidal drugs like diosgenin, cholesterol, stigmasterol and ergosterol. synthesis of progesterone and testosterone. Synthetic oestrogens like diethyl stilbesterol, hexosterol, 17-alpha ethinyl oestradiol, Interconversions of Estrone, Estriol, Estradiol. Chemistry of keto and non keto adreno corticoids. A note on anabolic steroids (Structure and uses).

**Cardiac glycosides:** structures of glycosides from Digitalis, Strophanthus, Squill and Bufo. Enzymatic and acid hydrolytic reactions of the glycosides. Mechanism of action, SAR, therapeutic uses and toxicity.

**Vitamins:** Classification, structure and related function in enzyme and physiological activity. Chemistry of thiamine, riboflavin, Niacin, Pyridoxine, Vitamin A, D, E, K. structural elucidation of Riboflavin, Vitamin D.

**Text Books:**

- 1) JB Harborne, Phyto Chemical methods. Springer.
- 2) I L Finar, Organic chemistry, Vol. 1 & 2, the English language book society, London, New Delhi.
- 3) O.P. Agarwal, Natural products by. Vol.1 & 2, Goel publications – Meerut.

**Reference Books:**

1. RT Morrison and R.N Boyd, Organic chemistry, Allyn and Bacon, inc., boston
2. Me –Wolf, ed., Burger's medicinal chemistry, J. Wiley & sons, NY.
3. F.G. Mann & B. Saunders, Practical Organic chemistry Longmans green & Co. Ltd., UK.
4. RM. Acheson, an introduction to the chemistry of heterocyclic compounds, Interscience NY.
5. Duquesn & others, Practical pharmacognocny, CBS Publ.

**BPH 405B: HOSPITAL & COMMUNITY PHARMACY****UNIT-1**

1. Hospital Pharmacy – Definition, Hospital organization, Pharmacy organization and personnel, Location and layout of a hospital pharmacy unit in a hospital, responsibilities of a hospital pharmacist.
2. Pharmacy and therapeutics committee, Hospital formulary, Dispensing to inpatients (a) Floor stock system, (b) Individual prescription order system, (c) Combination of (a) and (b), Dispensing to out patients.

**UNIT-2**

1. Purchase and inventory control in hospitals and in community pharmacy, Storage of drugs.
2. Drug information center, Central sterile supply, Intravenous drug admixture, Unit dose dispensing, prepackaging in the hospital
3. Manufacturing – Bulk and sterile handling of controlled drugs, Current state of hospital Pharmacy in India.

**UNIT-3**

1. Community Pharmacy: (1) Drug house management – selection of site, space, layout, and legal requirements, Structure of pharmacy organization.
2. Sales promotion: Market research-salesmanship, qualities of a salesman, advertising and window display.

**UNIT-4**

1. Recruitment, training, evaluation of pharmacists and compensation to the pharmacist.
2. Pharmacy finance: Capital requirements, sources of pharmacy capital, Risk management and insurance.

**Reference Books:**

1. Merchant and Qadry's text book of hospital pharmacy revised by Dr. Ramesh K Goyal and RK Parikh; BS Shah Prakashan Publications.
2. Hospital Pharmacy by William E Hassan.
3. Pharmacy management for students and practitioners, by C. Patrick Tharp and Pedro J Lecca.
4. Remington's Pharmaceutical Sciences.



**BPH 405C: PHARMACOVIGILANCE****UNIT –I**

Introduction to Pharmacovigilance  
History and development of Pharmacovigilance  
Importance of safety monitoring / Why Pharmacovigilance  
National and international scenario  
Pharmacovigilance in India  
Pharmacovigilance global perspective  
WHO international drug monitoring programme

**UNIT –II**

Basic terminologies used in Pharmacovigilance  
Terminologies of adverse medication related events  
Information resources in Pharmacovigilance  
Establishing Pharmacovigilance programme  
Establishing in a hospital  
Establishment & operation of drug safety department in industry  
Establishing a national programme  
SOPs – Types, designing, maintenance and training  
Roles and responsibilities in Pharmacovigilance  
Licence Partners, Contract Research Organisations (CROs) and Market Authorisation Holders (MAH)

**UNIT –III**

Pharmacovigilance methods  
Passive surveillance – Spontaneous reports and case series  
Stimulated reporting  
Active surveillance – Sentinel sites, drug event monitoring and registries  
Comparative observational studies – Cross sectional study, case control study and cohort study

**UNIT –IV**

Adverse drug reaction reporting  
Introduction to reporting systems  
Spontaneous reporting system  
Reporting to regulatory authorities  
Guidelines for reporting ADRs in biomedical literature  
Communication in Pharmacovigilance

**TEXTBOOKS**

1. Textbook of Pharmacovigilance by S.K. Gupta, Jaypee brothers.
2. Pharmacovigilance by Ronald D. Mann, Elizabeth B.Andrews, 2<sup>nd</sup> edition.

## **BPH 406: MEDICINAL CHEMISTRY-III PRACTICALS**

### **I. EXPERIMENTS:**

1. Synthesis of hydrazones of benzoic acid
2. Synthesis of Eosin from Fluoroscein
3. Synthesis of benzilic acid from benzil
4. Synthesis of Sulphanilamide
5. Synthesis of 1,4- naphthaquinone from naphthalene
6. Synthesis of ortho iodo benzoic acid from anthranilic acid
7. Synthesis of Diazo amino benzene from aniline
8. Synthesis of acid hydrazides from salicylic acid
9. Synthesis of chalcones
10. Assay of Sulpha methoxazole (anti bacterial)
11. Assay of Glibenclamide (hypoglycaemic agent)
12. Assay of Metronidazole (antiprotozoal)
13. Assay of Isoniazid (anti tubercular)
14. Assay of Diethylcarbamazine (antihelmentic)
15. Assay of Compound benzoic acid (anti fungal)

### **II. DEMO/WORKSHOP**

Vacuum drying, Chemdraw, Chems sketch, Recrystallization process, Separation of ternary mixtures

### **III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

Water in phase transfer catalysis, Current topics on Cancer, Antibiotics, Anti-oxidants and chemotherapy of infectious diseases.

### **References:**

1. A.I. Vogel, Text Book of Practical Organic Chemistry, 5th Edition. Pearson, Prentice Hall.
2. F.G. Mann & B.C. Saunders, Practical Organic Chemistry, 4th Edition, Pearson Publishers.
3. I.P. – 1996.
4. P.D.Sethi – Quantative Analysis of Drugs in Pharmaceuticals. Formulations, CBS Publishers.
5. B.P. - 2004.

### **List of minimum EQUIPMENTS required**

1. Water bath
2. Suction pumps
3. Analytical/physical balance
4. Triple beam balance
5. Reflux flask with condenser
6. Hot plates
7. Refrigerator
8. Mechanical and magnetic stirrer with thermostat
9. Distillation unit
10. Oven
11. Adequate glass wares

### **BPH 407: PHARMACOLOGY-III PRACTICALS**

#### **A. EXPERIMENTAL PART**

1. Experiments on Isolated Preparations:
  - a. Calculate the  $PA_2$  value of atropine using acetylcholine as an agonist on rat ileum preparation.
  - b. Calculate the  $PA_2$  value of chlorpheniramine using histamine as an agonist on guinea pig ileum preparation.
  - c. Find out the strength of the given sample (e.g. Acetylcholine, Histamine, 5-HT, Oxytocin etc.) using a suitable isolated muscle preparation by
    - i. Interpolation bioassay
    - ii. Matching or bracketing bioassay
    - iii. Three point bioassay
    - iii. Four point bioassay
2. Experiments on intact animals like
  - a. Study of drug induced catatonia in rats
  - b. Study of muscle relaxant activity (rotarod apparatus)
  - c. Study of antipsychotic activity (pole climb response apparatus)
  - d. Study of antianxiety activity (elevated plus maze)
  - e. Study of analgesic activity (analgesimeter)
  - f. Study of anti-inflammatory activity (plethysmometer)
  - g. Study of antidepressant activity (swim test & tail suspension test)
  - h. Study of anticonvulsant activity (electroconvulso meter)
- i. Study of spontaneous motor activity and locomotor activity (actophotometer)

#### **B. DEMO/ WORK SHOP**

- a. Screening of antiulcer activity
- b. Invitro antioxidant activity
- c. Screening of antihistaminic activity (histamine chamber)

#### **C. SEMINAR/ ASSIGNMENT/ GROUP DISCUSSION**

- a. BABE studies
- b. Invitro-in vivo correlation studies
- c. Pharmacovigilance
- d. Biostatistics and its application

#### **REFERENCES**

1. Practicals in pharmacology By Dr.R.K.Goyal
2. Handbook of experimental pharmacology By S.K.Kulakarni
3. Experimental pharmacology By M.N.Ghosh
4. Experimental Pharmacology and Toxicology By Dr.B.M.VrushabendraSwamy and Prof.K.N.Jayaveera, S.Chand & Co.,

### **BPH 408: PHARMACOGNOSY-III PRACTICALS**

#### **I.EXPERIMENTS:**

1. Determination of moisture content.
2. Determination of Ash values, water soluble ash, acid insoluble ash.
3. Determination of extractive values.
4. Isolation of quinine from Cinchona
5. Isolation of vasicine from Vasaka leaves.
6. Preparation of herbal formulations like, herbal syrups,
7. TLC of any one alkaloid and one glycoside.
8. Preparation and evaluation of any one herbal cosmetic. churnas and the like.
9. Preparation and evaluation of any one Ayurvedic formulation.
10. Phytochemical screening of a plant material.
11. Paper chromatography of any one type of phytoconstituents.

#### **II.DEMO/WORKSHOP:**

Column chromatography of plant extract, estimation of any one phytoconstituent by Modern chromatographic methods.

#### **III.SEMINAR/ASSIGNMENT/GROUP DISCUSSION:**

Related to theory syllabus

##### ***Text Books:***

1. *Practical Pharmacognosy*. -C.K.Kokate Nirali Prakashan
2. *Practical Pharmacognosy*-Iyengar Manipal press limited

#### **LIST OF MINIMUM EQUIPMENTS REQUIRED**

1. Waterbath
2. Hotplates
3. Soxhlet extractor
4. Microscopes
5. Glass slides
6. Muffle furnace
7. Incinerator
8. Crucible
9. Colorimeter
10. Analytical balance
11. Heating mantle
12. Adequate glassware

## **BPH 409: BIOPHARMACEUTICS & PHARMACOKINETICS PRACTICALS**

### **I. EXPERIMENTS**

- 1) Analysis of biological samples for drug content and estimation of the pharmacokinetic parameters.
- 2) In vitro evaluation of tablet/capsule for drug release
- 3) Drug-protein binding studies.
- 4) Statistical treatment of pharmaceutical data.
- 5) Problems related to pharmacokinetics – determination of PK Parameters
- 6) Problems related to bioavailability and bioequivalence.

### **II. DEMO/ WORKSHOP**

1. Absorption studies – in vitro.
2. Experiments designed for the estimation of various pharmacokinetic parameters.

### **III. SEMINAR/ASSIGNMENT/GROUP DISCUSSION**

Chronopharmacokinetics.

#### **Text Books:**

1. L. Shargel and ABC Yu, textbook of applied biopharmaceutics & Pharmacokinetics, 4th edn, Appleton – century – crofts, Connecticut, 2004.
3. Milo Gibaldi, Biopharmaceutics and clinical pharmacokinetics 4/Edn. Pharma Book Syndicate. Hyderabad.
4. DM Brahmankar and SB Jaiswal, biopharmaceutics and pharmacokinetics- a treatise, vallabh prakasham, Delhi.

#### **Reference Books:**

1. Ronald & trouser. Clinical pharmacokinetics concepts & applications. 3rd ed, wolterskluwer Pvt Ltd., 2007.
2. Robert E notary, Biopharmaceutics and pharmacokinetics – an introduction, marcel dekker inc., NY
3. Basic pharmacokinetics by Hedaya, CRC press.

## **IV B.PHARM- II SEMESTER**

### **BPH 410: NOVEL DRUG DELIVERY SYSTEMS**

#### **UNIT I**

Concepts of controlled release, sustained release, extended release, timed release and delayed release. Rationale behind the design of above delivery systems. Factors influencing the design and performance of sustained and controlled release dosage forms.

#### **UNIT II**

**Oral Control Drug Delivery Systems:** Fundamentals, Dissolution Controlled, Diffusion Controlled, Ion Exchange Resins, Osmotic based systems, pH Independent Systems, altered density systems and use of polymers in controlled drug delivery.

#### **UNIT III**

**Targeted Drug Delivery Systems:** Fundamentals and applications, formulation and evaluation of nano particles, resealed erythrocytes and liposomes and niosomes.

#### **UNIT IV**

**Transdermal Drug Delivery Systems:** Fundamentals, permeation of drugs across the skin, types of TDDS, Materials employed and Evaluation of TDDS.

**Mucoadhesive Delivery Systems:** Mechanism of bioadhesion, mucoadhesive materials, formulation and evaluation of Buccal and Nasal drug delivery systems.

#### **Text Books:**

1. Robinson JR and Vincent HL. Controlled drug delivery fundamentals and applications, 2<sup>ed</sup>, marcel dekker 2005.
2. Yiew Chien, Novel drug delivery systems, 2<sup>nd</sup>ed, marcel dekker 2003.

#### **Reference Books:**

1. N.K. Jain, Advances in Control & Novel drug delivery, CBS Publishers.
2. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences
3. E.A. Rawlins, Bentley's Text Book of Pharmaceutics, Elbspubl

## **BPH 411: PHARMACEUTICAL BIOTECHNOLOGY**

### **UNIT I**

**Fermentation Technology:** Isolation, Selection, Screening of Industrially important microbes, Strain improvement. Types, design & operation of Bioreactor. Types of fermentations, optimization of fermentation process, Principle and Procedure involving in downstream process and effluent treatment. **Specific Fermentations:** Selection of organism, fermentation & purification of antibiotics (penicillin, streptomycin, tetracycline, and erythromycin), vitamins (riboflavin and cyanocobalamine), lactic acid, alcohol and acetone.

### **UNIT II**

**Recombinant DNA Technology:** Introduction to r-DNA technology and genetic engineering, steps involved in isolation of enzymes, vectors, recombination and cloning of genes. Production of bio technology derived therapeutic proteins like humulin, humatrop, activase, intron a, monoclonal antibodies by hybridoma technique, recombivax HB (hepatitis b). Stem cells and their applications.

### **UNIT III**

**Immunology & Immunological Preparations:** Principles of Immunity, Humoral immunity, cell mediated immunity, antigen – antibody reactions, hypersensitivity and its applications. Active & passive immunizations vaccine preparation, standardization & storage of BCG, cholera, smallpox, polio, typhus, tetanus toxoid, immuno serum & diagnostic agents.

### **UNIT IV**

**Enzyme Technology:** Techniques of immobilization of enzymes, factors affecting enzyme kinetics, advantages of immobilization over isolated enzymes. Study of enzymes such as hyaluronidase, penicillinase, streptokinase, streptodornase, amylase, protease etc. immobilization of bacteria & plant cells.

Introductory study & applications of bioinformatics, proteomics and genomics, Nanobiotechnology, Gene therapy.

#### **Text Books:**

1. Wulf Crueger and Anneliese Crueger, Biotechnology, 2<sup>nd</sup> Ed, Publ- Panima publication cooperation, New Delhi.
2. P. F. Stanbury & A. Whitaker, Principles of fermentation technology, Pergamon Press.
3. J. D. Watson, Recombinant DNA technology. 2<sup>nd</sup> Edition, W.H. Freeman 1992.
4. S.P.Vyas and Dixit, Pharmaceutical Biotechnology, CBS Publishers New Delhi.

#### **Reference Books:**

1. Prescott and Dunne, "Industrial Microbiology" MC Graw Hill Book Company.
2. K. Kielslich "Biotechnology" Vol 6, Verlegchemic, Switzerland.
3. PF Standury & A. Whitaker, "Principles of fermentation Technology" Pergamon Press, Oxford.
4. A. Wiseman, Handbook of enzyme biotechnology. 3<sup>rd</sup> Edition Elis Horwood.
5. Alexande M Moo-young, Comprehensive Biotechnology, Pergamon Press, New York

**BPH 412: CLINICAL. PHARMACY & THERAPEUTICS****UNIT-1**

General concept: Clinical pharmacokinetics, drug interactions, adverse drug reactions, parenteral nutrition, Pharmacoeconomics, Pharmacogenomics, Pharmacovigilance, Therapeutic drug monitoring, Neutraceuticals, essential drugs and rational drug usage.

Age related drug therapy: concept of posology, drug therapy for neonates, pediatrics and geriatrics. Drugs used in pregnancy and lactation.

**UNIT-2**

Drug therapy in gastrointestinal, hepatic, renal, cardiovascular and respiratory disorders.  
Drug therapy for neurological and psychological disorders.

**UNIT-3**

Drug therapy in infections of respiratory system, urinary system, infective meningitis, TB, HIV, malaria and filaria.  
Drug therapy for thyroid and parathyroid disorders, diabetes mellitus, menstrual cycle disorders, menopause and male sexual dysfunction.

**UNIT-4**

Drug therapy for malignant disorders like leukemia, lymphoma and solid tumors.  
Drug therapy for rheumatic, eye and skin disorders.

**BPH 413: COMPREHENSIVE VIVA VOCE****BPH 414: PROJECT WORK & SEMINAR**



**SRI VENKATESWARA UNIVERSITY**  
**B. PHARMACY SYLLABUS**  
**Choice based credit system (CBCS): w.e.f. 2016-17.**

**MODEL PAPERS**

**Model question paper for practical course**

**B.PHARMACY - SEMESTER**

Title of the Paper

**Time 3 Hrs**

**Max marks 80M**

1. Synopsis	10 marks
2. Major experiment	40 marks
3. Minor experiment	30 marks
4. Viva voce	10 marks
5. Record	10marks
Total: 100 marks	

**Model question paper for theory course**

**B.PHARMACY - SEMESTER**

Title of the Paper

**Time 3 Hrs**

**Max marks 80M**

Attempt any five from part A ( $5 \times 4 = 20$  marks) and all from Part B ( $4 \times 15 = 60$  marks)

**PART A ( $5 \times 4 = 20$  marks)**

1. Unit 1
2. Unit 1
3. Unit 2
4. Unit 2
5. Unit 3
6. Unit 3
7. Unit 4
8. Unit 4

**PART B ( $4 \times 15 = 60$  Marks)**

9. Unit 1 a or b
10. Unit 2 a or b
11. Unit 3 a or b
12. Unit 4 a or b

\*\*\*\*\*