DEPARTMENT OF PHARMACEUTICAL SCIENCES

UNDER

SUSHRUTA SCHOOL OF MEDICAL & PARAMEDICAL SCIENCES

REGULATIONS & SYLLABUS

FOR

FOUR-YEAR BACHELOR OF PHARMACY (B.PHARM) PROGRAMME

(UNDER SEMESTER PATTERN)
(w.e.f. 2015-16)

ASSAM UNIVERSITY: SILCHAR

(A CENTRAL UNIVERSITY)

SILCHAR, ASSAM, 788011, INDIA

REGULATIONS FOR THE BACHELOR OF PHARMACY COURSE, DEPARTMENT OF PHARMACEUTICAL SCIENCES UNDER SUSHRUTA SCHOOL OF MEDICAL AND PARAMEDICAL SCIENCES, ASSAM UNIVERSITY, SILCHAR-788011, ASSAM

1. **Eligibility for Admission to the First Year of the B.Pharm Course**

   a) Candidates belonging to all categories except Scheduled Castes / Scheduled Tribes/ OBC(with NCL) for admission to the B. Pharmacy course must have obtained individual pass marks in Physics, Chemistry, Biology or Mathematics both in theory and practical. Not less than 50% aggregate marks in the above subjects is mandatory at the qualifying examination (Academic Stream) after a period of 12 years of study i.e.10 + 2 pattern of education recognised by Assam University and Pharmacy Council of India.

   b) Candidates belonging to Scheduled Castes / Scheduled Tribes /OBC (with NCL)must have obtained individual pass marks in Physics, Chemistry, Biology or Mathematics both in Theory & Practical and with not less than 45% aggregate marks in the above subjects.

2. **Academic Calendar**

   a) The academic session is divided into two semesters of 90 working days duration: an odd semester (July-December) and an even semester (January-June) for all the years.

   b) The schedule of the academic activities for a session inclusive of dates of registration, and examinations shall be laid down in the Academic Calendar by the Sushruta School of Medical and Paramedical Sciences (SSMPS) for each session.

3. **Admission**

   a) The admission processes are monitored by the admission committee constituted by the Vice Chancellor (VC) on the recommendation of the Dean, SSMPS with duration of one year.

   b) Admission to B. Pharm course shall be made in the odd semester of each academic session at the first year level through written and oral test conducted by Department of Pharmaceutical Sciences as per University Rule.

   c) The reservation policy for the Scheduled Castes(SC), Scheduled Tribes(ST), Other Backward Community (OBC) and Physically Challenged(PC) candidates will be followed as per the guidelines as stipulated by GOI, for the Academic Institutions.

   d) If, at any time after provisional admission, it is found that a candidate has not fulfilled all the requirements stipulated in the offer of admission, the admission committee may recommend for revocation of the candidate.

   e) University reserves the right to cancel the admission of any student and ask him/her to discontinue his/her studies at any stage of his/her career on the grounds of unsatisfactory academic performance or undisciplined conduct.

4. **Attendance**

   Attendance requirement in all Lectures, Tutorials, Laboratories and Practical in each subject will be as per university norms.

5. **Duration of the course**

   Four year divided into eight semesters. Normally a student should complete all the requirements for B. Pharm course in eight semesters. However, who do not fulfill some

of the requirements in their first attempt may be permitted up to 16 semesters or 8 years from the first admission to complete all the requirements of degree.

6. Course structure

a) The papers in which the candidates will be examined for the First and Second, Third and Fourth, Fifth and Sixth, Seventh and Eighth Semester Examinations shall be as per Annexure-I, II, III and IV respectively.

b) Teaching of the courses shall be reckoned in credits; credits are assigned to the courses based on the following pattern; one credit for each lecture / tutorial period of one hour, two credits for each laboratory/ practical of three hours duration.

c) A regular record of theory and practical class work and sessional and class tests conducted in the academic session shall be maintained for each student and the internal assessment/ sessional marks shall be awarded on the basis of these.

d) The students shall undergo Industrial/Hospital Training for 2(two) weeks after 6^{th} semester during Summer Vacation. Report based on this shall be submitted in the 7^{th} Semester for assessment.

e) Every student in 7^{th} semester will be allotted a project work (Theoretical / Practical). There will be seminar and viva voce for assessment on project literature during 7^{th} semester examination and final project during 8^{th} semester examination. The evaluation of the project will be based on project report and a seminar presenting the report

f) Distribution of sessional and semester examination marks, eligibility for appearing examination and promotion to higher semester is as per university norms.

7. For any matter not covered under these regulations, the existing University Rules, Ordinances and the Assam University Act 1989(as amended) shall be applicable.

ANNEXURE-I

Semester-I									
Course code	**Subject**	**L**	**T**	**P**	**Marks**				**Credits**
					In sem		**End sem**		
					Total mark	**Pass mark**	**Total mark**	**Pass mark**	
BPH101	Professional Communication	2	1	-	30	12	70	28	3
BPH 102	Mathematics and Statistics	3	1	-	30	12	70	28	4
BPH 103	Basics of Computer Applications	3	0	-	30	12	70	28	3
BPH 104	Basics of Computer Applications (Practical)	-	-	3	30	12	70	28	2
BPH 105	Anatomy, Physiology and Pathophysiology I	3	0	-	30	12	70	28	3
BPH106	Anatomy, Physiology and Pathophysiology (APP I) (Practical)	-	-	3	30	12	70	28	2
BPH107	Pharmaceutical Chemistry – I (organic chemistry-I)	4	0	-	30	12	70	28	4
BPH108	Pharmaceutical Chemistry – I (organic chemistry-I) Practical	-	-	3	30	12	70	28	2
BPH109	Pharmaceutics-I (General Pharmacy)	3	0	-	30	12	70	28	3
	Total	**18**	**2**	**9**					**26**
Contact hours / week: 29 (Theory: 20 hours, Practical: 09 hours)		**Grand Total marks: 900 (Theory: 600, Practical: 300)**					**Total credit: 26**		

L: Lecture, T: Tutorial, P: Practical

Semester-II									
Course code	**Subject**	**L**	**T**	**P**	**Marks**				**Credits**
					In sem		**End sem**		
					Total mark	**Pass mark**	**Total mark**	**Pass mark**	
BPH 201	Anatomy, Physiology and Pathophysiology II	3	0	-	30	12	70	28	3
BPH202	Anatomy, Physiology and Pathophysiology (APP II) (Practical)	-	-	3	30	12	70	28	2
BPH203	Pharmaceutics-II (Dispensing Pharmacy)	3	1	-	30	12	70	28	4
BPH204	Pharmaceutics-II (Dispensing Pharmacy) Practical	-	-	3	30	12	70	28	2
BPH205	Pharmaceutical Chemistry-II (Inorganic Chemistry)	3	1	-	30	12	70	28	4
BPH206	Pharmaceutical Chemistry-II (Inorganic Chemistry) (Practical)	-	-	3	30	12	70	28	2
BPH207	Pharmaceutical Chemistry – III (organic chemistry-II)	3	1	-	30	12	70	28	4
BPH208	Pharmaceutical Chemistry – III (organic chemistry-II Practical)	-	-	3	30	12	70	28	2
BPH 209	Hospital Pharmacy	3	0	-	30	12	70	28	3
	Total	**15**	**3**	**12**					**26**
Contact hours / week: 30 (Theory: 18 hours, Practical: 12 hours)		**Grand Total marks: 900 (Theory: 500, Practical: 400)**					**Total credit: 26**		

L: Lecture, T: Tutorial, P: Practical

ANNEXURE-II

Semester-III									
Course code	**Subject**	**L**	**T**	**P**	**Marks**				**Credits**
					In sem		**End sem**		
					Total mark	**Pass mark**	**Total mark**	**Pass mark**	
BPH301	Pharmaceutics-III (Physical Pharmacy)	3	0	-	30	12	70	28	3
B PH302	Pharmaceutics-III (Physical Pharmacy) Practical	-	-	3	30	12	70	28	2
B PH303	Pharmaceutical Engineering-I (Unit operation-I)	3	0	-	30	12	70	28	3
B PH304	Pharmaceutical Engineering-I (Unit operation-I) Practical	-	-	3	30	12	70	28	2
B PH305	Pharmacognosy-I	3	0	-	30	12	70	28	3
B PH306	Pharmacognosy- I (Practical)	-	-	3	30	12	70	28	2
B PH307	Anatomy, Physiology and Pathophysiology III	3	0	-	30	12	70	28	3
B PH308	Pharmaceutical Analysis-I	3	0	-	30	12	70	28	3
B PH309	Pharmaceutical Analysis-I (Practical)	-	-	3	30	12	70	28	2
BPH 310	Environmental Studies	2	1	-	30	12	70	28	3
	Total	**17**	**1**	**12**					**26**
Contact hours / week: 30 (Theory: 18 hours, Practical: 12 hours)		**Grand Total marks: 1000 (Theory: 600, Practical: 400)**					**Total credit: 26**		

L: Lecture, T: Tutorial, P: Practical

Semester-IV									
Course code	**Subject**	**L**	**T**	**P**	**Marks**				**Credits**
					In sem		**End sem**		
					Total mark	**Pass mark**	**Total mark**	**Pass mark**	
BPH401	Pharmacognosy-II	3	1	-	30	12	70	28	4
BPH402	Pharmacognosy- II Practical	-	-	3	30	12	70	28	2
BPH403	Pharmaceutical Engineering-II (Unit operation-II)	3	1	-	30	12	70	28	4
BPH404	Pharmaceutical Engineering-II (Unit operation-II) Practical	-	-	3	30	12	70	28	2
BPH405	Pharmaceutical Biochemistry	3	1	-	30	12	70	28	4
BPH406	Pharmaceutical Biochemistry Practical	-	-	3	30	12	70	28	2
BPH407	Pharmaceutical Analysis-II	3	0	-	30	12	70	28	3
BPH408	Pharmaceutical Analysis-II (Practical)	-	-	3	30	12	70	28	2
BPH409	Anatomy, Physiology and Pathophysiology IV	3	0	-	30	12	70	28	3
	Total	**15**	**3**	**12**					**26**
Contact hours / week: 30 (Theory: 18 hours, Practical: 12 hours)		**Grand Total marks: 900 (Theory: 500, Practical: 400)**					**Total credit: 26**		

L: Lecture, T: Tutorial, P: Practical

ANNEXURE-III

Semester-V									
Course code	**Subject**	**L**	**T**	**P**	**Marks**				**Credits**
					In sem		**End sem**		
					Total mark	**Pass mark**	**Total mark**	**Pass mark**	
B PH501	Pharmaceutics-IV (Pharmaceutical Technology-I)	3	1	-	30	12	70	28	4
B PH502	Pharmaceutics-IV (Pharmaceutical Technology-I) Practical	-	-	3	30	12	70	28	2
B PH503	Pharmaceutical Microbiology	3	0	-	30	12	70	28	3
B PH504	Pharmaceutical Microbiology Practical	-	-	3	30	12	70	28	2
B PH505	Pharmaceutical Chemistry – IV (Medicinal Chemistry-I)	3	1	-	30	12	70	28	4
B PH506	Pharmaceutical Chemistry – IV (Medicinal Chemistry-I) Practical	-	-	3	30	12	70	28	2
B PH507	Pharmacology-I	3	0	-	30	12	70	28	3
B PH508	Pharmacology- I (Practical)	-	-	3	30	12	70	28	2
B PH509	Pharmaceutical Jurisprudence and Ethics	3	1	-	30	12	70	28	4
	Total	**15**	**3**	**12**					**26**
Contact hours / week: 30 (Theory: 18 hours, Practical: 12 hours)		**Grand Total marks: 900 (Theory: 500, Practical: 400)**					**Total credit: 26**		

L: Lecture, T: Tutorial, P: Practical

Semester-VI									
Course code	**Subject**	**L**	**T**	**P**	**Marks**				**Credits**
					In sem		**End sem**		
					Total mark	**Pass mark**	**Total mark**	**Pass mark**	
B PH601	Pharmaceutics-V (Pharmaceutical Technology - II)	3	1	-	30	12	70	28	4
B PH602	Pharmaceutics-V (Pharmaceutical Technology - II) Practical	-	-	3	30	12	70	28	2
B PH603	Pharmaceutical Chemistry- V (Medicinal Chemistry- II)	3	1	-	30	12	70	28	4
B PH604	Pharmaceutical Chemistry- V (Medicinal Chemistry- II) Practical	-	-	3	30	12	70	28	2
B PH605	Pharmacognosy-III	3	1	-	30	12	70	28	4
B PH606	Pharmacognosy-III Practical	-	-	3	30	12	70	28	2
B PH607	Pharmacology-II	3	0	-	30	12	70	28	3
B PH608	Pharmacology-II Practical	-	-	3	30	12	70	28	2
B PH609	Pharmaceutical Biotechnology	3	0	-	30	12	70	28	3
	Total	**15**	**3**	**12**					**26**
Contact hours / week: 30 (Theory: 18 hours, Practical: 12 hours)		**Grand Total marks: 900 (Theory: 500, Practical: 400)**					**Total credit: 26**		

L: Lecture, T: Tutorial, P: Practical

ANNEXURE-IV

Semester-VII									
Course code	**Subject**	**L**	**T**	**P**	**Marks**				**Credits**
					In sem		**End sem**		
					Total mark	**Pass mark**	**Total mark**	**Pass mark**	
BPH701	Pharmaceutics-VI (BioPharmaceutical & Pharmacokinetics)	3	1	-	30	12	70	28	4
BPH702	Pharmacology-III	3	0	-	30	12	70	28	3
BPH703	Pharmaceutical Analysis – III	3	1	-	30	12	70	28	4
BPH704	Pharmaceutical Analysis- III Practical	-	-	3	30	12	70	28	2
BPH705	Pharmaceutical Chemistry VII (Chemistry of Natural Product)	3	1	-	30	12	70	28	4
BPH706	Pharmaceutical Chemistry VII (Chemistry of Natural Product) Practical	-	-	3	30	12	70	28	2
BPH 707 (a/b/c/d)	Elective-I	3	0	-	30	12	70	28	3
BPH 708 (a/b/c/d)	Elective I Practical	-	-	3	30	12	70	28	2
BPH709	Industrial/Hospital Training	-	-	-	30	12	70	28	2
	Total	**15**	**3**	**9**					**26**
Contact hours / week: 27 (Theory: 18 hours, Practical: 09 hours)		**Grand Total marks: 900 (Theory: 500, Practical including training: 400)**					**Total credit: 26**		

L: Lecture, T: Tutorial, P: Practical

Elective Subjects

BPH-707 (a):	Herbal Drug Technology	BPH-707 (b):	Cheminformatics & Drug Design
BPH-708 (a):	Herbal Drug Technology (Practical)	BPH 708 (b):	Cheminformatics & Drug Design (Practical)
BPH 707 (c):	Cosmetic Technology	BPH-707 (d):	Bioassays
BPH-708 (c):	Cosmetic Technology Practical	BPH-708 (d):	Bio Assay Practical

Semester-VIII									
Course code	**Subject**	**L**	**T**	**P**	**Marks**				**Credits**
					In sem		**End sem**		
					Total mark	**Pass mark**	**Total mark**	**Pass mark**	
BPH801	Pharmaceutics-VII (Pharmaceutical Technology-III)	3	1	-	30	12	70	28	4
BPH802	Pharmaceutics-VII (Pharmaceutical Technology-III) Practical	-	-	3	30	12	70	28	2
BPH803	Pharmaceutical Chemistry- VI (Medicinal Chemistry- III)	3	1	-	30	12	70	28	4
BPH804	Clinical Pharmacy & Drug interaction	3	0	-	30	12	70	28	3
BPH805	Quality assurance	3	1	-	30	12	70	28	4
BPH806	Pharmaceutical Management	3	0	-	30	12	70	28	3
BPH 807	Project Work	-	-	6	30	12	70	28	2
BPH808	Comprehensive Viva Voce				30	12	70	28	4
	Total	**15**	**3**	**9**					**26**
Contact hours / week: 27 (Theory: 18 hours, Practical: 9 hours)		**Grand Total marks: 800 (Theory: 500, Practical including project work: 200, Comprehensive Viva Voce: 100)**					**Total credit: 26**		

L: Lecture, T: Tutorial, P: Practical

Grand total marks for eight semesters: 7200
Grand total credits for eight semesters: 208

SEMESTER-I

PROFESSIONAL COMMUNICATION

Course Code: BPH 101
Credits: 3 (L-2, T-1 hours/week) Marks: 100

UNIT – I

Communication with reference to Business Communication, writing Technical Proposals, etc.

- **a.** Verbal and non-verbal, spoken and written
- **b.** Language functions-descriptive, expressive and social
- **c.** Bias-free and plain English
- **d.** Formal and informal style
- **e.** A brief introduction to communication skills, especially for job interviews – body language, choice of words, etc.

UNIT – II

Communicative Grammar

- **a.** Time, tense and aspect
- **b.** Verbs of states and events
- **c.** Statements, questions and responses
- **d.** Expressing emotion and attitude, hope, pleasure, disappointment, regret, approval, surprise.

UNIT-III

The Sounds of English

- **a.** The Consonant sounds of English
- **b.** The Vowel sounds – monophthongs and diphthongs
- **c.** Rhythm, Intonation and Weak forms in English

UNIT – IV

Communication skills

- **a.** To ask for information, help, permission
- **b.** To instruct, command, request, accept, refuse, prohibit, persuade, promise
- **c.** Friendly communication – greeting, farewell, introduction, thanks, apologies, regrets, good wishes congratulations, condolences, offers
- **d.** Making presentations, debating, telephonic conversations.

UNIT-V

- **a.** Curriculum Vitae
- **b.** Report Writing
- **c.** Paragraph writing
- **d.** Application writing
- **e.** Research papers and articles
- **f.** To read and comprehend selected materials – articles / magazines / journals

RECOMMENDED BOOKS:

1. Geoffrey Leach and Jan Svartvik, Longman, A communicative Grammar of English
2. J.D. O' connor, Better English Pronunciation, ELBS
3. J.K.Chand and B.C. Das, A Millennium Guide to writing and Speaking English, Friends' Publishers
4. John Sealy, Oxford guide to writing and speaking

MATHEMATICS AND STATISTICS

Course Code: BPH 102 Marks: 100
Credits: 4 (L-3, T-1 hours/week)

UNIT I

Differential Calculus: Limits and functions, definition of differential coefficient, differentiation of standard functions, including function of a function (chain rule). Differentiation of implicit functions, logarithmic functions, parametric functions, successive differentiation.

UNIT II

Integral Calculus: Integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, substitution and partial fractions, formal evaluation of definite integrals.
Differential equations: Order of differential equation, solution of 1^{st} order differential equations by variable separable method, 2^{nd} order differential equations with constant coefficient.

UNIT III

Bio-statistics-I: Data Organisation and representation by pie, bar, 2-D and 3-D diagrams. Measure of central tendency, Measures of dispersion.

UNIT IV

Bio-statistics-II: Correlation and regression analysis (simple & multiple), method of least square. Standard deviation, standard error. Probability, probability theorems, elementary ideas of binomial, poison and normal distributions, Student t-test (paired t-test, two sample t-test), F-test, Chi-square test, application of biometrics in Pharmaceutical Sciences.

UNIT V

Laplace transforms: Definition, transforms of elementary functions, properties of linearity and shifting, inverse laplace transforms, transforms of derivatives, solution of ordinary and simultaneous differential equations

RECOMMENDED BOOKS:

1. A Text Book of Mathematics for XI, XII students, NCERT Publications, Vol-I to IV.
2. Higher Engineering Mathematics by Dr.J.S. Grewal. (Khanna publishers, New Delhi)
3. Bio-Statistical Analysis. Czar, Pearson Education Pvt. Ltd.
4. Fundamentals of Mathematical Statistics by V. K. Gupta & Kapoor, Sultan Chand & Co. Ltd.

BASICS OF COMPUTER APPLICATION

Course code: - BPH 103 Marks: 100
Credits: - 03 (L-3 hours/week)

UNIT I

Computer Fundamentals

Introduction to Computer, Computer classifications (according to generation, size and use), Computer Organization.
Basics of Operating system and functions - DOS and Windows, Data representation - Binary system; bits, bytes, ASCII codes

UNIT II

Hardware: Introduction to hardware, CPU, Storage Devices and Memory. Various ports and slots - ISA, PCI Serial, Parallel, PS/2 and USB. Hard disk, processors, RAM, ROM, and Input/ Output devices

Software: Introduction to software, Classification

UNIT III

Introduction to MS OFFICE

MS Word: Document creation, editing, formatting

MS Excel: Data Input & Import, Data Analysis, Formulae, Charts

MS PowerPoint: Creation of PowerPoint presentation, slide show, animation, action buttons

UNIT IV

Problem Solving and Programming

Introduction to problem solving: Problem analysis, algorithm, flow chart, coding, execution, debugging and testing, program documentation and validation. Programming in C - Identifiers, keywords, data types, declaring variables, control structures, loops, simple programs

UNIT V

Basics of Internet and Networking: Introduction and history of Internet, overview of computer networks - LAN, MAN and WAN. World Wide Web, Browser and Search engine.

Application of Computers in Pharmacy: Use of Computers in Pharmaceutical industry - drug design and clinical studies. Pharmaceutical information portals on drugs, medical literature, plants, adverse effects, clinical data, patent sites, FDA, WHO, Pharmacopoeia, GLP, GMP.

RECOMMENDED BOOKS:

1. Computer and common sense, 4th edn., Hunt & Shelly, Prentice-Hall India
2. Complete Reference MS Office
3. Programming in ANSI C by E. Balagurusamy, Tata McGraw-Hill
4. W. Stallings, Data and Computer Communications, Pearson

BASICS OF COMPUTER APPLICATIONS PRACTICAL

Course code: BPH 104 Marks:100

Credits: 02 (3 hours /week)

1. Demonstration of computer hardware parts.
2. Command prompt of operating system DOS and WINDOWS
   a. Searching directories or folders
   b. Creating and deleting files and folders
   c. Copying and Moving files and folders / directories
   d. CD Writing, printing
3. Simple programs in C language
4. MS-Office (MS Word, MS Power point, MS Excel).
5. Internet (Search engine, email)

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY-I (APP-I)

Course code: BPH 105 Marks: 100
Credits: 03 (L-3 hours/week)

UNIT I

1. Basic terminologies used in anatomy and physiology, levels of structural organization, body cavities and their membrane, planes and sections.(Introduction to human body and organization of human body).
2. Functional and structural characteristics of cell organelles (structure and functions), and cell cycle.
3. Detailed structure of cell membrane and physiology of transport process (Including enzymes and co-enzymes).

UNIT II

1. Skeletal System-Structure, composition and functions of skeleton, classification of joints, types of movement of joints.
2. Anatomy and physiology of skeletal muscle and smooth muscle, physiology of skeletal muscle and disorders.
3. Contraction, energy metabolism, types of muscle contraction, muscle tone.

UNIT III

1. Structural and functional characteristics of tissue: epithelial, connective, muscle and nerve.
2. Haemopoietic system: - composition, and function of blood, physiological roles of RBC, WBC and platelets, erythropoiesis, blood groups, blood coagulation, disorder of platelets and coagulation.

UNIT IV

1. **Lymph and Lymphatic System:** Composition, formation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen.

UNIT V

1. Concepts of health & disease, agents causing communicable diseases & prevention of disease.
2. Classification of food requirements, Balanced diet, Nutritional deficiency disorders, their treatment & prevention, specification for drinking water.

RECOMMENDED BOOKS:

1. Anatomy and Physiology in Health and Illness by Ross and Willson (Churchill living stone)
2. Concise Medical Physiology by S.K.Choudhury (New central book agency, Calcutta)
3. Guyton A C, Hall JE., Text book of Medical Physiology, W.B.Sandnders Company
4. Human Physiology, C C Chatterjee, Medical allied agency, Calcutta
5. Tortora G.J., S.R.Grabowski & Anagnodokos N.P., Principles of Anatomy & Physiology
6. Dorasari and Gandhi's elements of Human anatomy, Physiology and health education by Thakorebhai P.gandhi & R.K.Goyal (B.S.Shah Prakashan).
7. Tale: Anatomy & Physiology

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY I (APP-I) PRACTICAL

Course Code: BPH 106 Marks: 100
Credits: 02(3 hours/week)

1. Study of human skeleton.
2. Study of the following systems with the help of charts and models.
   Haematopoietic System
   Lymphatic System
   Cardiovascular System
   Skeletal Muscles
3. Estimation of haemoglobin in blood.
4. Determination of bleeding time and clotting time.
5. RBC count.
6. Total and differential leucocytes counts.
7. Determination of ESR.
8. Blood group determination.
9. Recording of body temperature, pulse rate and blood pressure.
10. Study of spleen, RBC, WBC's etc with the help of prepared slides (Based on theory).

PHARMACEUTICAL CHEMISTRY–I (Organic Chemistry-I)

Course code: BPH 107 Marks: 100
Credits: 04 (4 hours/week)

UNIT I

Structure and Properties: Atomic Structure, atomic orbital, molecular orbital, hybridization, sigma & pi bond, covalent, electrovalent and co-ordinate bond, inductive effect and resonance, Classification & Nomenclature of organic compounds.

UNIT II

Isomerism: Classification, Geometrical isomerism, Cahn Ingold Prelog System of E/Z notation, Stereoisomerism, including optical activity, specification of absolute configuration, Cahn Ingold Prelog System of R/S notation and conformational analysis.

UNIT III

Important methods of preparation and reactions with special reference to mechanism of the following classes of compounds: Alkanes, alkenes, alkynes & dienes, free radical substitution reaction, alkyl halides and alcohols.

UNIT IV

Arenes: Aromatic character, structure of benzene, resonance, orientation of electrophilic aromatic substitution, amines (aliphatic & aromatic), phenols, aryl halides.

UNIT V

Aldehydes and ketones (aliphatic & aromatic), carboxylic acids (mono, di &tricarboxylic acids), hydroxyacids.

Organometallic Compounds (Preparation and synthetic application): Grignard reagent and Organolithium compounds.

BOOKS RECOMMENDED:

1. Morrison, R.T., and Boyd R.N., Organic Chemistry, Prentice Hall of India Pvt. Ltd, New Delhi.
2. Finar, I.L., Organic Chemistry, Vol. I & II, ELBS/Longman.
3. Jain, M.K. Organic Chemistry, Sohan Lal Nag in Chand & Co. 60 B, Bunglaw Road, Delhi.
4. Hendrikson, Organic Chemistry.
5. Naming organic compounds by E.W. Godly.
6. Organic reactions Stereochemistry & Mechanism by P. S. Kalsi.
7. Named Organic Reactions by Thomas Laue and Andreas Plagens
8. Mann, F.G, & Saunders, B.C., Practical Organic Chemistry, ELBS/ Longman.
9. Vogel A.I., Textbook of Practical Organic Chemistry, ELBS/Longman.

PHARMACEUTICAL CHEMISTRY –I (Organic Chemistry-I) PRACTICAL

Course code: BPH 108 Marks: 100
Credits: 02(3 hours/week)

1. Identification of elements and functional groups in given sample.
2. Purification of solvents like Benzene, chloroform, acetone and preparation of absolute alcohol.
3. Synthesis of compounds involving benzoylation, acetylation, bromination, reduction & oxidation.
4. Synthesis of following compounds:
   Picric acid, Acetanilide, Aspirin, Hippuric acid, *p*-bromoacetanilide, Iodoform, Oxalic Acid.

PHARMACEUTICS - I (General Pharmacy)

Course code: BPH 109 Marks: 100
Credits: 03(3 hours/week)

UNIT I

Evolution of Pharmacy and Pharmaceutical Literature: History of Pharmacy, Historical background and importance of various Pharmacopoeias with special reference to Indian Pharmacopoeia, United States Pharmacopoeia, and British Pharmacopoeia.

UNIT II

Introduction and classification of pharmaceutical dosage forms: Tablets, Capsules, Syrups, Elixers, Suspensions, Emulsions, Gel, Suppositories, Powders, Ointments, Injectables.
Pharmaceutical additives**:** Colouring, flavouring & sweetening agents, co-solvents, preservatives, surfactants, antioxidants.

UNIT III

Pharmacopoeial Preparations: Principles and methods of preparation of aromatic waters, spirits, elixirs, linctus, solutions, milks and magmas, mucilages and special preparations like pyroxylins and flexible collodions.

Introduction to Pharmaceutical Waters: Purified water, Distilled water, Double distilled Water, Demineralised water, Water for injection.

UNIT IV

Galenicals: Principles and methods of extraction, preparation of infusions, decoctions, tinctures, liquid, soft and dry extracts.

UNIT V

Buffers: Buffer equations and buffer capacity, buffers in pharmaceutical systems, preparation, buffered isotonic solutions, measurements of tonicity, calculations and methods of adjusting isotonicity.

RECOMMENDED BOOKS:

1. Remington's Pharmaceutical Sciences, ed. A.R.Gennaro, Mack Publishing co., P.A.
2. Leon Lachmann, H.A. Lieberman and J.L. Kanig, "The Theory and Practice of Industrial Pharmacy", Lea & Febiger, Philadelhia/Varghese Publishing House, Mumbai.
3. Cooper & Gunn's Dispensing for Pharmaceutical students CBS Publishers, New Delhi
4. Pharmacopoiea of India, Published by the Controller of Publications, Delhi.
5. British Pharmacopoeia, 2003, Her Majesty's Stationary Office, University Press, Cambridge, U.K

SEMESTER-II

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY-II (APP-II)

Course code: BPH 201 Marks: 100
Credits: 03(L-3 hours/week)

UNIT I

1. **Digestive system:** Parts of digestive system, their structure and functions. Various gastrointestinal secretions & their role in digestion.
   Pathology of disorders related to digestive system Peptic Ulcer, Ulcerative colitis, Crohns disease, Amoebiasis, Cirrhosis of liver, Pancreatitis.

UNIT II

1. **Respiratory System:** Anatomy & function of respiratory structures, Mechanism of respiration, regulation of respiration, pathophysiology of Asthma, Pneumonia, Bronchits, Emphysema.

UNIT III

1. **Central Nervous System:** Functions of different parts of brain and spinal cord. Neurohumoral transmission in the central nervous system, reflex action, reticular activating system, electroencephalogram, specialized functions ofthe brain. Cranial nerves and their functions.

UNIT IV

1. **Autonomic Nervous System:** Physiology and functions of the autonomic nervous system (ANS). Mechanism of neurohumoral transmission within the ANS.

UNIT V

1. **Cell injury and Adaptation:** Causes of cell injury, pathogenesis & morphology of cell injury, intercellular alteration in lipids, proteins and carbohydrates, Cellular Adaptation- Atrophy, hypertrophy, aplasia, metaplasia, & dysplasia and pathophysiology of Neoplasm

RECOMMENDED BOOKS:

1. Anatomy and Physiology in Health and Illness by Ross and Willson (Churchill living stone)
2. Concise Medical Physiology by S.K.Choudhury
3. Guyton A C, Hall JE., Text book of Medical Physiology, W.B.Sandnders Company
4. Human Physiology, C C Chatterjee, Medical allied agency, Calcutta
5. Tortora G.J., & Anagnodokos N.P., Principles of Anatomy & Physiology
6. Tale: Anatomy & Physiology

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY-II (APP-II) PRACTICAL

Course code: BPH 202 Marks: 100
Credits: 02**(**3 hours/week**)**

1. Study of the following systems with the help of charts and models:
   Digestive system
   Respiratory system
   Central nervous system
   Autonomic nervous system
   Urinary system
   Reproductive system
   Endocrine system
   Sense organs
2. Determination of vital capacity
3. Software demonstration of experiments on nerve muscle preparation.
4. Microscopic study of different tissues
5. Study and preparation of permanent slides

PHARMACEUTICS-II (Dispensing Pharmacy)

Course Code: BPH 203 Marks: 100
Credits: 04 (L-3, T-1 hours/week)

UNIT I

Prescription: Various parts of prescription and their functions, handling of prescriptions, sources of errors, Preliminary knowledge of important Latin terms used in prescriptions and their translation into English

UNIT II

Pharmaceutical calculations and metrology: Metric and imperial systems of weights and measures used in prescriptions

Posology: Calculations of doses for infants, children, and elderly patients; reducing and enlarging formulae; percentage solutions; allegations methods; proof spirits; calculations involving alcohol dilutions.

UNIT III

Principles and procedures of dispensing prescriptions: Principles involved and procedures adopted in dispensing of Liquid preparations such as mixtures, suspensions, emulsions, solutions, lotions, paints, sprays and inhalations; Semisolid preparations such as ointments, creams, pastes, jellies and liniments, poultices; solid dosage forms such as powders, capsules, effervescent powders, tablet triturates and lozenges and suppositories.

UNIT IV

Incompatibilities: Definitions, Types of incompatibility (Physical, Chemical and Therapeutic incompatibility), Study of examples of prescriptions containing incompatibilities, their correction and dispensing methods.

UNIT V General Dispensing

General dispensing procedures and guidelines including labelling of dispensing products, care required in dispensing procedures.

RECOMMENDED BOOKS:

1. Cooper & Gunn's Dispensing for Pharmaceutical students CBS Publishers, New Delhi
2. Dispensing Pharmacy by R.M. Mehta (Vallabh Prakashan, Delhi)
3. Remington's Pharmaceutical Sciences, ed. A.R. Gennaro, Mack Publishing co., P.A.

PHARMACEUTICS-II (Dispensing Pharmacy) PRACTICAL

Course Code: BPH 204 Marks: 100
Credits: 02 (3 hours/week)

1. Preparation of selected pharmacopoeial preparations under the category of aromatic waters, spirits, solutions, infusions, tinctures and extracts.
2. Dispensing procedures involving pharmaceutical calculations, dosage calculations for paediatric patients, etc.
3. Dispensing of prescriptions falling under the categories of mixtures, solutions, emulsions, creams, ointments, powders, suppositories, pastes, jellies, lotions liniments, inhalations and paints etc.
4. Dispensing of prescriptions involving adjustment of tonicity
5. Identification of various types of incompatibilities in prescriptions, correction and dispensing of such prescriptions.

PHARMACEUTICAL CHEMISTRY–II (Inorganic Chemistry)

Course code: BPH 205 Marks: 100
Credits: 04 (L-3, T-1 hours/week)

UNIT I

1. An outline of methods of preparation, uses, sources of impurities, tests for purity and identity, including limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests if any, of the above mentioned classes of inorganic pharmaceuticals included in Indian Pharmacopoeia.
2. Acids and Bases: Buffers, Gastrointestinal Agents: Acidifying agents (Dil HCl), Antacids (Aluminum hydroxide gel, Magnesium carbonate, Sodium bicarbonate), Protectives

(Bismuth subcarbonate) and Adsorbents (Light kaolin), Cathartics (Magnesium sulphate), Emetics (Copper sulphate).

UNIT II

1. Essential and Trace Elements: Transition elements and their compounds of pharmaceutical importance, Iron as haematinics, mineral supplements.
2. Topical Agents: Protectives (Calamine, Titanium dioxide), Astringents (Alum, Zinc sulphate) and Anti-infective (Povidone iodine, Hydrogen peroxide, Potassium permanganate, Silver nitrate, Boric acid).

UNIT III

1. Gases and Vapours: Inhalents (Oxygen), Anaesthetics (nitrous oxide) and Respiratory stimulants (Ammonium carbonate).
2. Dental Products: Dentifrices (Dicalcium Phosphate and Calcium Carbonate); Desensitizer (Strontium Chloride) and Anti-caries agents (Sodium Fluoride and Stannous Fluoride).

UNIT IV

1. Inorganic Radio-pharmaceuticals and Contrast Media: Nuclear radiopharmaceuticals, nomenclature, methods of obtaining their standards and units of activity, measurement of activity (Geiger Muller Counter), clinical applications and dosage, hazards and precautions, Contrast Media (Barium Sulphate)

UNIT V

1. Major Intra and Extra-cellular Electrolytes: Physiological ions, Electrolytes used for replacement therapy, acid–base balance and combination therapy.
2. Miscellaneous Agents: Sclerosing agents, expectorants, poisons and antidotes.

RECOMMENDED BOOKS:

1. Inorganic Medicinal and Pharmaceutical Chemistry by Block, Roche, Soine, Wilson.
2. Bentley and Driver's Text Book of Pharmaceutical Chemistry.
3. Pharmaceutical Chemistry – Inorganic by G.R.Chatwal.
4. Pharmaceutical Chemistry-I by Dr. N.C. Chaudhry and Dr. N.K. Gurbani

PHARMACEUTICAL CHEMISTRY–II (Inorganic Chemistry) PRACTICAL

Course code: BPH 206 Marks: 100
Credits: 02 (3 hours/week)

1. Preparation and testing of purified water
2. Limit test for chlorides and sulphates in some pharmacopoeial compounds.
3. Limit test for iron and lead.
4. Limit test for arsenic.
5. Identification of radicals in mixtures:
   Acid radicals: at least two mixtures.
   Basic radicals: at least two mixtures.
6. Preparation and identification tests of the following official (IP) compounds.
   (i) Magnesium sulphate (ii) Ferrous Sulphate
   (iii) Boric Acid (iv) Disodium hydrogen citrate

PHARMACEUTICAL CHEMISTRY – III (Organic chemistry-II)

Course Code: BPH 207 Marks: 100
Credits: 04 (L-3, T-1 hours/week)

UNIT I

α, β Unsaturated carbonyl compounds. Compounds containing active methylene group and their synthetic importance: Acetoacetic ester and malonic ester.
Polynuclear hydrocarbons: Napthalene, anthracene and phenantherene.

UNIT II

Heterocyclic Compound: Nomenclature, Chemistry, preparation, properties and pharmaceutical importance of pyrrole, furan, thiophene, pyridine, pyrimidine, imidazole, pyrazole, thiazole, benzimidazole, indole and phenothiazines.

UNIT III

Name reactions: Definition, reaction mechanism and synthetic application of Meerwien–Pondorff–Verley reduction, Oppenaeur oxidation, Beckmann rearrangement, Mannich reaction, Diel's Alder reaction, Michael reaction, Reformatsky reaction, Knoevanegal reaction and Benzoin condensation.

UNIT IV

Carbohydrates: Classification, structure, reactions, structure elucidation, identification of:

1. Monosaccharides: Glucose and fructose
2. Disaccharides: Sucrose and lactose.
3. Polysaccharides: Starch.

UNIT V

1. Classification, identification, general methods of preparation and reactions of amino acids and proteins
2. Structure of Nucleic Acids.
3. Chemistry & identification of oils, fats and waxes.
4. Polymers and polymerization.

BOOKS RECOMMENDED

1. Mann P G & Saunders B C, Practical Organic Chemistry, ELBS/ Longman, London.
2. Furniss B S, Hannaford A J, Smith P W G and Tatehell A R, Vogel's Textbook of Practical Organic Chemistry, The ELBS/ Longman, London.
3. Morrison, T.R. and Boyd, R.N., Organic Chemistry, Prentice Hall of India, Private Limited, New Delhi.
4. Finar, I.L., Organic Chemistry Vol. I & II, ELBS/Longman.
5. Jain, M.K. and Sharma S.C, Organic Chemistry, Shoban Lal Nag in Chand & Co., Delhi.
6. P.S. Kalsi Organic Reactions Stereochemistry & Mechanism.

PHARMACEUTICAL CHEMISTRY-III (Organic chemistry-II) PRACTICAL

Course Code: BPH 208 Marks: 100
Credits: 02 (3 hours/week)

1. Identification of organic compounds and their mixture with derivatization.
2. Synthesis of organic compounds involving two steps.
3. Determination of Iodine value, saponification value, Acid value, Ester value of oils, fats and waxes

HOSPITAL PHARMACY

Course code: BPH 209 Marks: 100
Credits: 03 (L-3 hours/week)

UNIT I

1. **Organization and Structure**: Organization of a hospital and hospital pharmacy, responsibilities of a hospital pharmacist, Pharmacy and Therapeutic Committee, budget preparation and implementation.
2. **Hospital Formulary**: Contents, preparation and revision of hospital formulary.

UNIT II

1. **Drug Store Management and Inventory Control:** (a) Organization of drug store, Types of materials stocked, storage conditions. (b) Purchase and Inventory Control principles, purchase procedures, Purchase order, Procurement and stocking.
2. **Drug distribution System in Hospitals**: (a) Outpatient dispensing, methods adopted. (b) Dispensing of drugs to in-patients. Types of drug distribution systems. Changing policy, labelling.

UNIT III

1. **Central Sterile Supply Unit and their Management**: Types of materials for sterilization, packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials.
2. **Manufacture of Sterile and Non sterile Products**: Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice, master formula card, production control, manufacturing records.

UNIT IV

1. **Surgical Products:** Definition, Primary wound dressing, absorbents, surgical cotton, surgical gauzes, bandages, adhesive tape, protective cellulosic haemostatics, dressings, absorbable and nonabsorbable sutures, ligatures and catguts.

UNIT V

1. **Drug Information Services**: Sources' of information on drugs, disease, treatment schedule, procurement of information, computerized services (e.g. MEDLINE), retrieval of information, medication error.
2. **Records and Reports**: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc.

RECOMMENDED BOOKS:

1. Hassan William E., Hospital Pharmacy (Lea & Febiger, Philadelphia)
2. Nand P., Khar R.K., Text book of Hospital & Clinical Pharmacy (Birla publication, Delhi)
3. Dandiya P.C. & Mathur M., A text book of Hospital & Clinical Pharmacy (Vallabh Prakashan, Delhi).

SEMESTER-III

PHARMACEUTICS-III (Physical Pharmacy)

Course code: BPH 301 Marks: 100
Credits: 03 (L-3 hours/week)

UNIT I

1. **Matter, Properties of Matter:** State of matter, change in the state of matter, latent heats and vapour pressure, sublimation, critical point, eutectic mixtures, gases, aerosols, inhalers, relative humidity, liquid complexes, liquid crystals, glassy state, solids- crystalline, amorphous and polymorphism.

UNIT II

1. **Surface and Interfacial Phenomenon:** Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid-gas and solid-liquid interfaces, complex films, electrical properties.

UNIT III

1. **Solubility and related Phenomenon:** Solubility expression, determination of solubility, solubility of gases in liquids, solubility of liquids in liquids, solubility of solids in liquids.
2. **Rheology:** Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, Newtonian and non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling sphere, rotational viscometers.

UNIT IV

1. **Micromeretics and Powder Rheology :** Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle size, volume, shape, surface area, specific surface, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT V

1. **Dispersion Systems:** Colloidal dispersions, types, properties of colloids, protective colloids, applications of colloids in pharmacy; Suspensions: Interfacial properties of suspended particles, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, Emulsions: theories of emulsification, physical stability and rheological considerations.

RECOMMENDED BOOKS:

1. Martin's Physical Pharmaceutical Sciences by P.J. Sinko (Lippincott William and Wilkins, Baltimore)
2. Cooper and Gunn's Tutorial Pharmacy edited by S.J. Carter
3. Bentley's Textbook of Pharmaceutics edited by E.A. Rawlins

PHARMACEUTICS-III (Physical Pharmacy) PRACTICAL

Course code: BPH 302 Marks: 100
Credits: 02 (3 hours/ week)

1. To determine molar mass by Rast method and cryoscopic method.
2. To determine refractive index of given liquids and find out the contribution of carbon, hydrogen and oxygen in molar refraction of a compound.
3. To determine molar mass of volatile liquids by Victor-Meyer method.
4. To determine the specific rotation of sucrose at various concentrations and determine the intrinsic rotation
5. To determine the heat of solution, heat of hydration and heat of neutralization.
6. To determine the cell constant, verify Ostwald dilution law and perform conductometric titration.
7. To determine rate constant of simple reaction
8. Determination of surface interfacial tension, HLB value and critical micellar concentration of surfactants.

PHARMACEUTICAL ENGINEERING - I (Unit Operations – I)

Course code: BPH 303 Marks: 100
Credits: 03(L-3 hours/week)

UNIT I

1. **Heat Transfer:** Heat transfer mechanism, Fourier's law of conduction. Compound resistance in series, Heat flow through cylinder, overall heat transfer coefficient, Temperature gradient in forced convection, Fluids in natural convection, Heat exchangers & Heat interchangers, Sources of heat, steam and electricity as heating media.
2. **Drying:** Moisture content and Mechanism of drying, Rate of drying and time of drying calculations. Classification and types of dryers, dryers used in pharmaceutical industries and special drying methods.

UNIT II

1. **Size Reduction and Size Separation:** Definition, objectives of size reduction and size separation, factors affecting size reduction, laws governing energy and power requirements of mills including ball mill, hammer mill, fluid energy mill , sieve analysis, standards of sieves, size separation equipment shaking and vibrating screens, gyratory screens, cyclone separator, air separator, bag filters, cottrell precipitator, scrubbers, size separators basing on sedimentation theory.

UNIT III

1. **Mixing and Homogenization:** Theory of mixing, mixing efficiency, solid-solid mixing, degree of mixing and statistical evaluation, factors affecting mixing, equipments, solid-liquid mixing and liquid-liquid mixing mechanism and equipments, homogenizers.

UNIT IV

1. **Evaporation:** Theory of evaporation, basic concept of phase equilibria, factors affecting evaporation, evaporators, film evaporator, single effect and multiple effect evaporator.

UNIT V

1. **Distillation:** Raoult's law, phase diagrams, volatility, simple, steam and flash distillations, principles of rectification, Mc cabe Thiel method for calculation of number of theoretical plates, Azeotropic and extractive distillation.
2. **Filtration:** Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter. Factors affecting filtration, optimum cleaning cycle on batch filters.

RECOMMENDED BOOKS:

1. Cooper and Gunn's Tutorial Pharmacy Edited by S.J.Carter (CBS Publishers, Delhi)
2. Pharmaceutical Engineering by K.Sanbamurty (New Age International, New Delhi)
3. Chemical Engineering by Badger and Banchero (Mc Graw Hill, New Delhi)

PHARMACEUTICAL ENGINEERING-I (Unit Operations – I) PRACTICAL

Course code: BPH 304 Marks: 100
Credits: 02 (3 hours/ week)

1. Experiments based on Determination of rate of evaporation.
2. Experiments based on Determination of rate of filtration and effect of filter aids.
3. Experiments based on steam, extractive and azeotropic distillations.
4. Experiments based on determination of size reduction and size separation.
5. Experiments based on sieve analysis.
6. Determination of rate of drying, free moisture content and bound moisture content.
7. Experiments to illustrate the influence of various parameters on the rate of drying.
8. Experiments to illustrate solid – solid mixing, determination of mixing efficiency using different types of mixers

PHARMACOGNOSY – I

Course code: BPH 305 Marks: 100
Credits: 03 (3 hours/week)

UNIT I

1. Definition, history, and scope of pharmacognosy.
2. Development of advanced pharmacognosy in respect to other pharmacy subjects and their co-relation.
3. Sources of drugs: Biological organism, marine, mineral and animal as sources of drugs.

UNIT II

1. Classification of natural drugs: Alphabetical, Morphological, Taxonomical, Chemical, Pharmacological/ Therapeutical and Chemotaxonomical classification of drugs.

UNIT III

1. Primary and secondary metabolites of plant origin and their general biosynthetic pathway study with example.
2. Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation

UNIT IV

1. Systematic Pharmacognostic study of the following :
   Lipids : Bees wax, Cod-liver oil, Hydnocarpus oil, Kokum butter, Lard, Shark liver oil.

UNIT V

1. Systematic Pharmacognostic study of the following:
   Carbohydrates and derived products: Agar, Guar gum, Honey, Isabgol, and Pectin

RECOMMENDED BOOKS:

1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Publishers : NiraliPrakashan,Pune; Fourteeth Edition edition (10 March 2008)
2. Trease G.E. and Evans W.C., Pharmacognosy (BallieneTindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers & Distributors, New Delhi,2005).
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len &Febiger, Philadelphia).

PHARMACOGNOSY–I PRACTICAL

Course code: BPH 306 Marks: 100
Credits: 02 (3 hours/week)

1. Processing and Evaluation of leaf constants (Stomatal number and stomatal index, Palisade ratio, vein islet and veinlet termination number).
2. Microscopic measurements of cells and cell contents – starch grains, trichrome and phloem fibres.
3. Identification of crude drugs belonging to carbohydrates (morphological and chemical).
   Identification of crude drugs belonging to lipids

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY-III (APP-III)

Course code: BPH 307 Marks: 100
Credits: 03 (3 hours/week)

UNIT I

1. **Endocrine System:** Basic anatomy and physiology of Pituitary, Thyroid, Parathyroid, Adrenals and Pancreas.

UNIT II

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

UNIT III

1. **Reproductive System**: Male and female reproductive systems and their hormones,physiology of menstruation, coitus and fertilization, Sex differentiation, spermatogenesis andoogenesis.

UNIT IV

1. **Demography and Family Planning,** Medical termination of pregnancy.
2. **First Aid:** Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.

UNIT V

1. Brief outline of the communicable diseases, their causative agents, mode of transmission and Prevention - Chicken pox, Measles, Influenza, Diphtheria, Whooping, cough, Tuberculosis, Leprosy, Poliomyelitis, Hepatitis, Cholera, Typhoid, Food poisoning, Helminthiasis, Malaria, Filariasis, Rabies, Trachoma, Tetanus, Syphilis, Gonorrhoea and AIDS.

RECOMMENDED BOOKS:

1. Pathologic basis of diseases by Robbins S.L. (Harcourt India, New Delhi).
2. Pathology Quick Review and MCQs based on Harsh Mohan's Text Book of Pathology (Jaypee brothers medical publishers, New Delhi)
3. Anatomy and Physiology in Health and Illness by Ross and Willson (Churchill living stone)
4. Concise Medical Physiology by S.K.Choudhury
5. Guyton A C, Hall JE., Text book of Medical Physiology, W.B.Sandnders Company Human Physiology, C C Chatterjee, Medical allied agency, Calcutta
6. Tortora G.J., & Anagnodokos N.P., Principles of Anatomy & Physiology.

PHARMACEUTICAL ANALYSIS -I

Course code: BPH 308 Marks: 100
Credits: 03 (L-3 hours/week)

UNIT I

1. Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Significance of figures. Rules for retaining significant digits. Types of errors, minimization of error, selection of sample, precision and accuracy. Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.

UNIT II

1. **Acid Base Titration:** Acid base concepts,Role of solvers, Relative strength of acids and bases, lonization, Law of mass action, Common ion effect, ionic product of water, pH, Hydrolysis of salts, Henderson-Hesselbalch equation, Buffers solutions, Neutralization curves, Acid-base indicators, Theory of indicators, Choice of indicators, Mixed indicators, Polyamine and amino acid systems. Amino acid titration, applications in assay, H_3PO_4, NaOH, $CaCO_3$ etc.

UNIT III

1. **Precipitation Titrations:** Precipitation reactions, solubility product, effect of acids, temperature and solvent upon the solubility of a precipitate, Argentometric titration and titrations involving ammonium or potassium thiocyanate, mercuric nitrate and barium sulphate, Indicators, Gay-Lussac method; Mohr's method, Volhard's method and Fajan's method.

UNIT IV

1. **Non-aqueous titrations:** Acidimetry & Alkalimetry. Basic principles, types of solvents, indicators. Titration with perchloric acid, sodium methoxide, potassium methoxide and tetrabutyl ammonium hydroxide for acidic & basic drug molecules.

UNIT V

1. **Gravimetric Analysis**: Precipitation techniques, solubility products. The colloidal state, supersaturation, co-precipitation, post precipitation, Digestion, washing of the precipitate, Filtration, Filter papers, and crucibles, Ignition. Thermogravimetric curves, specific examples like barium as barium sulphate, Aluminium as Aluminium oxide, calcium as calcium oxalate and magnesium as magnesium pyrophosphate.

RECOMMENDED BOOKS:

1. J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas. Vogel's Text Book of Quantitative Chemical Analysis.
2. A.H. Beckett and I.B. Stenlake, Practical Pharmaceutical Chemistry. Part I & II. The Athlone Press, London
3. K.A. Connors. A Text Book of Pharmaceutical Analysis. Johan Wiley & Sons
4. Indian pharmacopoeia

PHARMACEUTICAL ANALYSIS-I PRACTICAL

Course code: BPH309 Marks: 100
Credits: 02 (3 hours/week)

1. Standardization of analytical weights and calibration of volumetric apparatus.
2. Preparation and standardization of some secondary standard substance.
3. Assay of boric acid, zinc oxide, ammonium carbonate and amino acids.
4. Preparation and standardization of silver nitrate and ammonium thiocyanate.
5. Titration according to Mohr's and Volhard's methods.
6. Preparation and standardization of perchloric acid and sodium methoxide and assay of one official drug under each type.
7. Estimation of aluminium / calcium / barium / magnesium by gravimetric analysis.

ENVIRONMENTAL SCIENCE

**Course credits:-BPH 310 Marks: 100
Credits:- 03 (L-2, T-1 hours/week)

UNIT-I

1. The Earth and Its Environment

Environment and organism, The Earth- a "living Planet", Life on Earth, Interaction,

among organisms

2. Man and its Environment

Human Societies and Environment, Resources and Environment

UNIT-II

3. Basic concept of Ecology

Scope and relevance of Ecology, Concept of Biosphere, Concept pf Ecosystem,

Functional Analysis of Ecosystem, Nutrient or Biogeochemical cycles, Ecological

Succession, Species Diversity, Major Ecosystems

UNIT-III

Environmental Pollution

4. Pollution and its Types, Types of Pollutants, Air Pollution, Water Pollution, Noise Pollution, Ionizing radiation and pollution

5. Important Environmental Problems

Global Warming, Ozone layer Depletion, Acid Rain, Heavy Metal Pollution,

Pesticide Pollution, Oil Pollution in Ecosystem, Diminution of wildlife and

biodiversity, Deforestaion and Soil erosion.

UNIT-IV

6. Pollution and Health

Hazardous Chemicals and Human Health, Occupational Health Hazards, Pathogens,

Parasites and Health, Ionizing Radiation and Health

7. Environmental Conservation and Management

Concept, Objective and Principals of Conservation, Wildlife conservation in India,

Conservation of air and water quality, Forest Management and Social Forestry, Soil

Conservation and Land Use Planning

UNIT-V

8. Sustainable development and integrated environmental management

Concept of Sustainable development, Strategies for sustainable industry, agricultural

and urban development, Role of International cooperation n sustainable development

9. Environmental awareness & action.

Role of environmental education in generation of public awareness about environment, Role of non-government organizations (NGO's) in environmental conservation & spreading environmental awareness, International efforts in environmental conservation, Government action & environmental legislation in India.

BOOKS RECOMMENDED

1. **"**Our Environment" Assam University. Abhik Gupta, Mitra Dey, P.R. Bhattacharjee.

****- Common one semester paper of AUS for Undergraduate course may be changed by Competent Authority of the University.**

SEMESTER -IV

PHARMACOGNOSY – II

Course Code: BPH 401 Marks: 100
Credits: 04 (L-3, T-1 hours/week)

UNIT I

1. **Volatile Oils:** Definition, classification, general chemical test and use of volatile oil.General methods of extraction of volatile oils from plants. Study of biological source, chemical constituents, chemical tests and uses of volatile oils of Mentha, Lemon peel, Orange peel, Citronella, Caraway, Nutmeg, Chenopodium, Musk, Palmarosa, Gaultheria. Detailed Pharmacognosy of Clove, Coriander, Fennel, Sandal wood, and Eucalyptus.

UNIT II

1. **Resins**: Study of Drugs Containing Resins and Resin Combination like colophony, podophyllum, jalap, myrrh, asafoetida, balsam of tolu, balsam of Peru, benzoin,

UNIT III

1. **Tannins**: Definition and classification of tannins and tannin containing drugs like gambir, black catechu, gall and myrobalan.

UNIT IV

1. Natural allergens and photosensitizing agents.
2. Study of Antioxidants from plant origin and their role in disease prevention.

UNIT V

1. **Fibres**: Study of fibres used in pharmacy such as cotton, silk, glass wool and polyester.
2. **Pharmaceutical aids**: Study of pharmaceutical aids like talc, kaolin, bentonite, gelatin and natural colors (Turmeric, Saffron, Anato, Caramel, Cocheneal).

RECOMMENDED BOOKS:

1. Text Book of Pharmacognosy by Kokate C K, Purohit A P, Gokhale S B (Publishers : NiraliPrakashan,Pune; Fourteeth Edition edition (10 March 2008)
2. Trease G.E. and Evans W.C., Pharmacognosy (BallieneTindall, Eastbourne)
3. Text Book of Pharmacognosy by T.E.Wallis.(CBS Publishers & Distributors, New Delhi,2005).
4. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len &Febiger, Philadelphia).

PHARMACOGNOSY – II PRACTICAL

Course code: BPH 402 Marks: 100
Credits: 02 (3 hours/week)

1. Identification of crude drugs based on macroscopic and physical evaluation in theory (at least 3)
2. Study of fibres
3. Study of pharmaceutical aids.
4. Microscopic studies of three selected crude drugs and their powders mentioned in theory and their chemical tests.

PHARMACEUTICAL ENGINEERING – II (Unit Operations II)

Course code: BPH 403 Marks: 100
Credit: 04 (L-3, T-1 hours/week)

UNIT I

1. **Fluid Flow:** Type of flow, Reynold's number, Viscosity, concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.
2. **Dehumidification and Humidity Control:** Basic concepts and definition, wet bulb and adiabatic saturation temperature, psychrometric chart and measurement of humidity, application of humidity, measurement in pharmacy, equipments of dehumidification operations.

UNIT II

1. **Material Handling Systems:**
   Liquid handling – different types of pumps.
   Gas handling – various types of fans, blowers and compressors.
   Solid handling – Conveyers

UNIT III

1. **Centrifugations:** Theory of centrifugation and applications classification of centrifuges, industrial centrifugal filters and centrifugal sedimenters.

UNIT IV

1. **Crystallization:** Characteristics of crystals and factors affecting, Solubility curves and calculation of yields, material and heat balances around Swenson Walker Crystalizer. Mier's supersaturation theory and its limitations, nucleation mechanisms, crystal growth, study of various types of crystallizer, agitated batch, Swenson Walker and Krystal crystallizer, caking of crystals and its prevention.

UNIT V

1. **Materials of Construction:** General study of composition, corrosion, resistance, properties and applications of materials of construction with special reference to stainless steel and glass.
2. **Industrial Hazards and safety Precautions:** Mechanical, Chemical, Electrical, fire and dust hazards, industrial dermatitis.

RECOMMENDED BOOKS:

1. Cooper and Gunn's Tutorial Pharmacy Edited by S J Carter (CBS Publishers, Delhi)
2. Pharmaceutical Engineering by K.Sambamurty (New Age International, New Delhi)
3. Chemical Engineering by Badger and Banchero (MGH, New Delhi)

PHARMACEUTICAL ENGINEERING – II (Unit Operations II) PRACTICL

Course code: BPH 404 Marks: 100
Credits: 02 (3 hours/week)

1. Measurement of flow of fluids, determination of Reynolds number and frictional factor.

2. Determination of humidity – use of Dry Bulb and Wet Bulb temperatures and Psychrometric charts.
3. Experiments to demonstrate applications of centrifugation.
4. Experiments based on crystallization.
5. Other experiments based on theory.

PHARMACEUTICAL BIOCHEMISTRY

Course code: BPH 405 Marks: 100
Credits: 04(L-3, T-1 hours/week)

UNIT I

1. Biochemical organization of the cell and transport processes across cell membrane. Outlines of biochemistry of cell division and metastasis.
2. The concept of free energy, determination of change in free energy from equilibrium constant and reduction potential, bioenergetics, production of ATP and its biological significance.

UNIT II

1. **Enzymes:** Nomenclature, factors affecting enzyme action, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis.
2. **Co-enzymes and co-factors:** Vitamins as co-enzymes and their significance, metals as co-factor and their significance.

UNIT III

1. **Carbohydrate Metabolism:** Glycolysis and fermentation and their regulation, Gluconeogenesis, Glycogenolysis, Glycogenesis, and Pentose phosphate Pathway.
2. **The Citric Acid Cycle:** Significance, reactions and energetic of the cycle, Amphibolic role of the cycle and Anaplerosis.

UNIT IV

1. **Lipid Metabolism:** Oxidation of fatty acids: β-oxidation & energetics, α-oxidation, ω-oxidation, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, control of lipid metabolism, phospholipids and sphingolipids.

UNIT V

1. **Proteins and Nucleic acids:** Outlines of the mechanism of protein synthesis and nucleic acid synthesis and catabolism. Principles of biological oxidation and detoxification mechanisms.

RECOMMENDED BOOKS:

1. Harper's Biochemistry R.K.Murray and Others (Prentice Hall of India, New Delhi)
2. Biochemistry by Stryer.(W.H.Freeman, New York)
3. Text Book of Biochemistry by West & Todd (Oxford & IBH Pub., Co., New Delhi)
4. Fundamentals of Biochemistry by Dr.A.C.Deb (New Central Book Agency, Calcutta)
5. Text Book of Biochemistry by Dr.A.V.S.S.RamaRao (UBS Publishers & Distributors, New Delhi)
6. Text Book of Biochemistry by Dr.Satyanarayana

PHARMACEUTICAL BIOCHEMISTRY PRACTICAL

Course code: BPH 406 Marks: 100
Credits: 02 (3 hours/week)

1. Preparation of standard buffers (citrate, phosphate and carbonate) and measurement of pH.
2. Colorimetric estimation of blood glucose.
3. Estimation of cholesterol, creatinine, urea and uric acid in biological fluids.
4. Qualitative test for normal and abnormal constituents of urine.
5. Estimation of reducing sugars in urine.
6. Estimation of bilirubin content the blood.
7. Enzymatic hydrolysis of glycogen by alpha and beta amylases.
8. Effect of temperature on the activity of alpha amylases.
9. Estimation of Blood Cholesterol
10. Estimation of SGOT, SGPT by UV Spectrophotometer.
11. Estimation of serum alkaline phosphate and acid phosphatase levels.
12. Estimation of serum sodium, potassium and calcium levels

PHARMACEUTICAL ANALYSIS-II

Course code: BPH 407 Marks: 100
Credits: 03 (L-3 hours/ week)

UNIT I

Theoretical considerations and application in drug analysis and quality control of the following analytical techniques:

1. **Oxidation Reduction Titrations :** Concepts of oxidation and reduction, Redox reactions, strengths and equivalent weights of oxidizing and reducing agents, Theory of redox titrations, Redox indicators, cell representations, Measurement of electrode potential, Oxidation-reduction curves, Iodimetry and Iodometry, Titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate.

UNIT II

1. **Complexometric titration:** Types of complexometric titrations, Metal ion indicators, Complexometric titrations involving EDTA. Typical examples of complexometric titration
2. **Miscellaneous Methods of Analysis:** Diazotisation titrations, Kjeldahl method of nitrogen estimation, Karl-Fischer titration.

UNIT III

1. **Potentiometry**: Nernst equation, Reference electrode, Indicator electrode, basic principle and application of potentiometric method in different types of titration.
2. **Conductometry**: Measurement of conductivity, cell constant, application of conductivity measurements, basic principle and application of conductometric titrations.

UNIT IV

1. **Polarography:** Basic principle, Dropping Mercury Electrode, Method of Quantitative analysis, application of polarography.
2. **Amperometric titration**: Basic principle, Rotating platinum micro electrode, Types, Advantages and Application of amperometric titrations.
3. **Flame Photometry:** Basic principle, components and application of flame photometer

UNIT V

1. **Paper electrophoresis:** Basic principle, component of paper electrophoresis, Types, advantages, disadvantages and application of paper electrophoresis.
2. **Radioimmunoassay (RIA):** Basic principle, merits and demerits, methods and application of radioimmunoassay.
3. **X-Ray Difraction:** Basic Principle, Bragg's equation, instrumentation and application

RECOMMENDED BOOKS:

1. J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas. Vogel's Text Book of Quantitative Chemical Analysis.
2. A.H. Beckett and I.B. Stenlake, Practical Pharmaceutical Chemistry. Part I & II. The Athlone Press, London
3. K.A. Connors. A Text Book of Pharmaceutical Analysis. Johan Wiley & Sons.
4. Instrumental methods chemical analysis by B.K. Sharma
5. H H Willard, L.L. Merritt and J.A. Dean: Instrumental Methods of Analysis, Van Nostrand Reinhold, New York.

PHARMACEUTICAL ANALYSIS-II PRACTICAL

Course Code: BPH 408 Marks: 100

Credits: 02(3 hours/ week)

1. Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate etc. Some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, sodium 2, 6-ichlorophenolindophenol, and ceric ammonium sulphate.
2. Preparation and standardization of disodium EDTA solution. Assay of substances by using disodium EDTA.
3. Exercise involving diazotization**,** Kjeldahl, Karl-Fischer, shall be covered.
4. Exercise involving conductometric and potentiometric titration.
5. Estimation of Na^{+}**,** K^{+}**,** Ca^{++} ions using flame photometry.

ANATOMY, PHYSIOLOGY AND PATHOPHYSIOLOGY-IV (APP-IV)

Course Code: BPH 409 Marks: 100

Credits: 03(L-3 hours/week)

UNIT I

1. **Cardiovascular System –** Functional Anatomy of heart, conducting system of heart, blood vessels and blood circulation, cardiac cycle, ECG (Electro cardiogram), local control of blood flow and blood pressure regulation. Pathophysiology of, arteriosclerosis, hypertension, angina, CHF, myocardial infarction, cardiac arrhythmias, ischaemic heart disease

UNIT II

1. **Pathophysiology of diseases**: Diabetes, hepatic disorders like jaundice, viral hepatitis, hepatocellular carcinoma, portal hypertension, sexually transmitted diseases, common types of neoplasms like carcinoma of lung, skin cervix, colon & brief outline on different types of leukemia.

UNIT III

1. Basic mechanisms involved in the process of inflammation and repair Alterations in vascular permeability and blood flow, migration of WBC's, mediators of inflammation. Brief outline of the process of repair.

UNIT IV

1. Pathophysiology of Joints disorder: Arthritis, gout, myasthenia gravis, spasticity, tetany, fatigue.
2. Pathophysiology of anaemia, AIDS, hypersensitivity, allergic conditions, psychosis, epilepsy, Parkinson & Alzheimer's diseases pathophysiology of cataract, glaucoma etc**.**

UNIT V

1. **Sense organs**: Basic anatomy and physiology of the eye (vision), ear (hearing), taste (taste buds), nose (smell) and skin (superficial receptors).

RECOMMENDED BOOKS:

1. Pathologic basis of diseases by Robbins S.L. (Harcourt India, New Delhi).
2. Pathology Quick Review and MCQs based on Harsh Mohan's Text Book of Pathology (Jaypee brothers medical publishers, New Delhi)
3. Anatomy and Physiology in Health and Illness by Ross and Willson (Churchill living stone)
4. Concise Medical Physiology by S.K.Choudhury
5. Guyton A C, Hall JE., Text book of Medical Physiology, W.B.Sandnders Company Human Physiology, C C Chatterjee, Medical allied agency, Calcutta
6. Tortora G.J., & Anagnodokos N.P., Principles of Anatomy & Physiology.
7. Tale: Anatomy & Physiology

SEMESTER-V

PHARMACEUTICS-IV (Pharmaceutical Technology – I)

Course Code: BPH 501 Marks: 100
Credits: 04 (L-3, T-1 hours/week)

UNIT I

1. **Liquid Dosage Forms:** Introduction, types of additives used in formulations, Vehicles, stabilizers, preservatives, suspending agents, emulsifying agents, solubilizer, colors, flavours and others, manufacturing, packaging and evaluation of clear liquids, suspensions and emulsions.

UNIT II

1. **Semisolid Dosage Forms:** Definitions, types, semisolid bases and their selection. General formulation of semisolids: like ointments, creams, pastes & gels, their manufacturing procedure, evaluation and packaging.
2. **Suppositories:** Ideal requirements of bases and their types, manufacturing procedure, packaging and evaluation.

UNIT III

1. **Tablets**: Types of tablets, excipients used, and different granulation techniques used for preparation of tablets, types of tablet press tooling, manufacturing defects and evaluation of tablets.

UNIT IV

1. **Coating of Tablet:** Types of coating-sugar coating, film coating, enteric coating, film defects, materials used and evaluation of coated tablets.

UNIT V

1. **Capsules:** Advantages and disadvantages of capsule dosage forms, materials used for production of hard gelatin capsules, different sizes of capsules, methods of capsule filling. Soft gelatin capsules, capsule shell and content of capsules, importance of base absorption and minim/gm filling of soft gelatin capsules. Quality control and storage of capsule dosage forms.

RECOMMENDED BOOKS:

1. Bently's Textbook of pharmaceutics edited by E.A. Rawlins (All India Traveller Book Seller, New Delhi)
2. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig (Varghese Pub. House, Bombay)
3. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich (B.I.Waverly Pvt. Ltd., New Delhi)
4. Remington: The Science and Practice of Pharmacy, 20th Edition (Lippincott Williams & Wilkins, Baltimore)
5. Pharmaceutics: The Science of Dosage Form Design by Aulton (Churchill Livingstone, Edinburgh)

PHARMACEUTICS-IV (Pharmaceutical Technology – I) PRACTICAL

Course code: BPH 502 Marks: 100
Credits: 02 (3 hours / week)

Preparation, evaluation and packaging of liquid orals like solutions, suspensions and emulsions, ointments suppositories, tablets, capsules etc

PHARMACEUTICAL MICROBIOLOGY

Course code: BPH 503 Marks: 100
Credits: 03 (L-3 hours/ week)

UNIT I

1. Introduction to the scope of microbiology.
2. Classification of microbes and their taxonomy. Morphological study of Bacteria, Actinomycetes, Fungi, rickettsiae, spirochetes and viruses.
3. Identification of Microbes: Stains and types of staining techniques, electron microscopy.
4. Nutrition, cultivation and isolation bacteria, actinomycetes, fungi and viruses. Preservation microbial cultures.

UNIT II

1. Microbial genetics – Mutations, Isolation of mutants, factors influencing rate of mutation, mutagens. Transformation, conjugation, transduction and protoplast fusion.

UNIT III

1. Control of microbes by physical and chemical methods.

a) Disinfection, factors influencing disinfectants and antiseptics and their evaluation.

b) Sterilization, different methods, validation of sterilization methods & equipment.

UNIT IV

1. Test for sterility – Sampling media and general procedure. Control tests and inactivation of inhibitory substances.

UNIT V

1. Microbiological assay of antibiotics – penicillin, streptomycin and tetracycline, Vitamins – vitamin B_{12} and amino acids – lysine.

RECOMMENDED BOOKS:

1. Microbiology of Pelczar and Kreig.
2. Text Book of Microbiology by Anantanarayana and Panicker.
3. Dispensing for pharmaceutical students by Cooper and Gunn.
4. Bently's Text Book of Pharmaceutics.
5. Tutorial Pharmacy by Cooper and Gunn
6. Indian Pharmacopoeia
7. Shah and Shah (Pharmaceutical Microbiology)

PHARMACEUTICAL MICROBIOLOGY PRACTICAL

Course Code: BPH 504 Marks: 100

Credits: 02 (3 hours/ week)

Experiments devised to prepare various types of culture media, sub-culturing of common aerobic bacteria, fungi and yeast. Various staining methods, various methods of isolation of microbes, sterilization techniques and validation of sterilizing techniques, evaluation of antiseptics and disinfectants, Testing the sterility of pharmaceutical products as per I.P. requirements and Microbiological assay of antibiotics.

1. Preparation of Nutrient broth & Nutrient Agar medium
2. Preparation of Potato dextrose Agar medium
3. Subculture of aerobic bacteria, fungi and yeast by asceptic technique
4. Gram's staining Technique
5. Isolation of microbes by streak plate, spread plate methods.
6. Moist heat dry heat saterilization
7. Phenol coefficient method.
8. Test for sterility of Dextrose injection I.P.
9. Microbiological assay of antibiotics.
10. Demonstrating the use of membrane filtration technique.
11. Motility of bacteria using hang drop method.

PHARMACEUTICAL CHEMISTRY-IV (Medicinal Chemistry – I)

Course Code: BPH 505 Marks: 100
Credits: 04(L-3, T-1 hours/ week)

UNIT I

1. **Basic Principles of Medical Chemistry:** Physico-chemical aspects (Optical, geometric and bioisosterism) of drug molecules and biological action; Drug receptor interaction including transduction mechanisms.
2. **Drug Metabolism-** General pathways of drug metabolism, phase I and phase II reactions
3. **Prodrugs:** Definition, classification, characteristics and uses of prodrugs.

UNIT II

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class

1. **Adrenergic drugs and adrenergic blocking agents**: Adrenaline, Salbutamol, Phenylephrine, Naphazoline, Tolazoline, Propranolol
2. **Cholinergics, Anticholinesterases and antimuscarinic drugs** : Acetylcholine, Carbachol, Bethanechol, Methacholine, Neostigmine, Cycloptentolate and Dicyclomine

UNIT III

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class

1. **Antihistamines:** H1 receptor antagonist; Diphenhydramine, Mepyramine, Chlorpheniramine, Promethazine, Chlorcyclizine
2. **Antiulcer Agents**: H2 receptor antagonist and proton pump inhibitors; Cimetidine, Ranitidine, Omeprazole, Pantoprazole

UNIT IV

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class

1. **Eicosanoids** : Occurrences, Chemical nature, Medicinal applications
2. **Analgesics–antipyretics, anti-inflammatory (non-steroidal) agents**: Aspirin, Paracetamol, Ibuprofen, Phenylbutazone, Naproxan, Diclofenac sodium. \

UNIT V

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class

1. Insulin and its various preparations
2. Oral hypoglycaemic agents: Chloropropamide, Tolbutamide, Glibenclamide, Phenformin

BOOKS RECOMMENDED

1. Foye, W.C. “Principles of Medicinal Chemistry” Lea and Febiger, Philadelphia
2. Wilson and Giswold’s “Textbook of Organic, Medicinal and Pharmaceutical Chemistry” J. Lippincott Co., Philadelphia.
3. Burger’s Medicinal Chemistry, John Wiley and Sons, Newyark
4. D Sriram, P Yogeeswari, Medicinal Chemistry, Pearson, Delhi
5. A Kar, Medicinal Chemistry, New Age International (P) Ltd Publishers, New Delhi.

PHARMACEUTICAL CHEMISTRY-V (Medicinal Chemistry – I) PRACTICAL

Course Code: BPH 506 Marks: 100
Credits: - 02 (3 hours/week)

1. Synthesis of selected drugs and intermediates from the course contents
2. Monographs of selected official drugs including identification tests and tests for purity

PHARMACOLOGY-I

Course Code: BPH 507 Marks: 100
Credit-3 (L-3 hours/week)

UNIT I

1. Definition, historical development, and scope of pharmacology, sources of drugs. Mechanisms of drug action, receptors, receptor classification, theory of drug-receptor interactions, potentiation, antagonism phenomenon. Dose-Response curve, Therapeutics index -LD 50 and ED50.

UNIT II

1. Drug absorption and its mechanism, factors affecting drug absorption, routes of drug administration, bioavailability, bioequivalence, volume of distribution, plasma protein binding, half life of drug, biotransformation and cytochrome P450 monooxygenase system and excretion of drugs.

UNIT III

1. Autonomic neurotransmission, parasympathomimetics, parasympatholytics, sympathomimetics, sympatholytics, ganglion stimulant and blockers, neuromuscular blocking agents and local anaesthetics

UNIT IV

1. Neurohumoral transmission in CNS, general anaesthetics, alcohol and disulfiram, sedative-hypnotics, centrally acting muscle relaxants, anti-epileptics, opioid analgesic and antagonists.

UNIT V

1. Psychopharmacological agents-anti anxiety agents, antipsychotics, antidepressants, Antiparkinsonism drugs, CNS stimulants drugs used in Alzheimer disease.

RECOMMENDED BOOKS:

1. Essentials of Medical Pharmacology by K.D.Tripathi
2. Pharmacology and pharmacotherapeutics by Satoshkar and Bhandarkar
3. Pharmacology by Prasun K Das, S.K.Bhattacharya and P.Sen.
4. Text book of Pharmacology by S.D. Sethi
5. The Pharmacological basis of Therapeutics by Goodman and Gilman
6. Pharmacology by Rang, Dale and Ritter.
7. Basic and Clinical Pharmacology by B.G.Katzung.

PHARMACOLOGY – I PRACTICAL

Course Code: BPH 508 Marks: 100
Credits: 02 (3 hours/ week)

1. Introduction to Experimental Pharmacology
2. Preparation of different solutions for experiments
3. Common Laboratory animals and their maintenance
4. Study of commonly used instruments in experimental pharmacology

Procedures for rendering animals unconscious – stunning of rodents, chemical anaesthesia

5. Experiments on intact preparations; (In-vitro Experiments on Software basis recommended where use of animals are restricted**)**

Study of different routes of administration of drugs in mice / rats. To study the effect of hepatic microsomal enzyme inhibitors and induction on the pentobarbitone/hexobarbitone/thiopental sodium sleeping time in mice.

6. Experiments on Central Nervous System: (In-vitro Experiments on Software basis recommended where use of animals are restricted)

Recording of spontaneous motor activity, stereotypy, analgesia, anticonvulsant activity and muscle relaxant activity of drugs using simple experiments.

7. Effects of autonomic drugs on rabbit's eye.

8. Pharmacology of Cardiovascular System: (In-vitro Experiments on Software basis recommended where use of animals are restricted)

(a) To study the inotropic and chronotropic effects of drugs on isolated frog heart.

(b) To study the effects of drugs on normal and hypo dynamic frog heart.

PHARMACEUTICAL JURISPRUDENCE & ETHICS

Course code: BPH 509 Marks: 100

Credits: 04 (L-3, T-1 hours/week)

UNIT I

1. Pharmaceutical Legislations – A brief review
2. Code of Pharmaceutical Ethics.
3. Pharmacy Act – 1948

UNIT II

1. Drugs and Cosmetics Act 1940 and Rules 1945.

UNIT III

1. Medicinal & Toilet Preparations (Excise Duties) Act 1955
2. Narcotic Drugs & Psychotropic Substances Act 1985 & Rules
3. Drugs Price Control Order 1995
4. Drugs and Magic Remedies (Objectionable Advertisements) Acts 1954

UNIT IV

A brief study of the following with special reference to the main provisions only

1. Poisons Act 1919
2. Medical Termination of Pregnancy Act 1970 & Rules 1975

UNIT V

1. Prevention of Cruelty of Animals Act 1960
2. Factories Act 1948
3. Patents Act 2005

RECOMMENDED BOOKS:

1. A Textbook of Forensic Pharmacy by B.M. Mithal
2. A Textbook of Forensic Pharmacy by N.K. Jain
3. Drugs and Cosmetics Act and Rules published by Government of India
4. Pharmacy Act, Published by Government of India
5. Law of Drugs
6. Drug Cases published by International Law Book Co. Delhi (Reference)

SEMESTER-VI

PHARMACEUTICS – V (Pharmaceutical Technology II)

Course code: BPH. 601 Marks: 100
Credits: 04 (L-3, T-1hours / Week)

UNIT I

1. **Micro-encapsulation**: Types of microcapsule, applications of microencapsulation in pharmacy, microencapsulation by coacervation phase separation, multi orifice, spray drying, spray congealing, polymerization complex emulsion, air suspension technique and pan coating, evaluation of microcapsules.

UNIT II

1. **Parenteral Products**:

a. Routes of administration
b. Formulation: Vehicles, additives. containers and closures
c. Facilities: Design of aseptic area, housekeeping, surface disinfection, air control, personnel.
d. Processing: Cleaning of equipment, filling, sealing, sterilization, packaging and labelling.
e. Evaluation of parenteral products.

UNIT III

1. **Ophthalmic Preparations**: Types, Requirements, packaging, proper administration of ophthalmic preparations, contact lenses & care and use solutions.

UNIT IV

1. **Pharmaceutical Aerosols:** Definition, applications, components of aerosol package: Propellants, container, valve, general formulation, manufacturing and filling methods, evaluation.

UNIT V

1. **Packaging of Pharmaceutical Products**: Packaging components, types, specifications and methods of evaluation, stability aspects of packaging. Packaging equipments, factors influencing choice of containers, legal and other official requirements for containers, package testing.

RECOMMENDED BOOKS:

1. Bently's Textbook of pharmaceutics edited by E.A. Rawlins
2. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich
3. Remington The Science and Practice of Pharmacy, 20th Edition
4. Pharmaceutics : The Science of Dosage Form Design by Aulton

PHARMACEUTICS – V (Pharmaceutical Technology II) PRACTICAL

Course code: BPH 602 Marks: 100
Credits: 02 (3 hours/week)

1. Experiments to illustrate preparation, stabilization, physical and biological evaluation of pharmaceutical products like, parenterals, micro capsules, ophthalmic products etc.
2. Evaluation of materials used in pharmaceutical packaging.

PHARMACEUTICAL CHEMISTRY – V (Medicinal Chemistry – II)

Course Code: BPH 603 Marks: 100
Credits: 04 (L-3, T-1 hours/week)

UNIT I

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

1. **Steroids:** General study on Steroidal nomenclature and stereochemistry, Androgens and anabolic agents, Estrogens and progestational agents: Androstendione, Testosterone, Progesterone, Diethyl Stilbesterol, Oestrone
2. **CNS Stimulants:** Pemoline, Methylphenidate

UNIT II

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

1. **General Anaesthetics** : Ananesthetic ether, Halothane, Thiopental sodium.
2. **Local Anaestahetics** : Benzocaine, Procaine, Lignocaine, Dibucaine.
3. **Hypnotics and Sedatives**: Phenobarbitone, Cyclobarbitone, Glutethimide, Diazepam

UNIT III

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

1. **Anticonvulsants** : Phenytoin, Ethosuximide, Primidone, Carbamazepine
2. **Opioid analgesics and narcotic antagonist**: Pethidine, Methadone, Nalorphine
3. **Antiparkinsonism drugs**: Levodopa, Amantidine

UNIT IV

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

1. **Antipsychotic, Antidepressant and Anxiolytics:** Chlorpromazine, Chlorprothixene, Haloperidol, Imipramine, Phenelzine, Chlordiazepoxide, Buspirone
2. **Diuretics:** Acetazolamide, Chlorthiazide, Hydrochlorthiazide, Furosemide, Ethacrynic acid
3. **Hypolipidemic Agents:** Cholestipol, Probucol, Gemfibrozil

UNIT V

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

1. **Cardiovascular drugs:** Clonidine, Methyldopa, Procainamide, Nifedipine, Isosorbide dinitrate, Prazocin, clofibrate.
2. **Oral anticoagulant:** Warfarin, Dicoumarol

BOOKS RECOMMENDED

1. Foye, W.C. “Principles of Medicinal Chemistry” Lea and Febiger, Philadelphia
2. Wilson and Giswold’s “Textbook of Organic, Medicinal and Pharmaceutical Chemistry” J. Lippincott Co., Philadelphia.
3. Burger’s Medicinal Chemistry, John Wiley and Sons, Newyark
4. D Sriram, P Yogeeswari, Medicinal Chemistry, Pearson, Delhi
5. A Kar, Medicinal Chemistry, New Age International (P) Ltd Publishers, New Delhi.

PHARMACEUTICAL CHEMISTRY – V (Medicinal Chemistry – II) PRACTICAL

Course Code: BPH 604 Marks: 100
Credits: 02(3 hours/week)

1. Synthesis of selected drugs from the course content
2. Monographs of selected official drugs including identification tests and tests for purity

PHARMACOGNOSY-III

Course code: BPH 605 Marks: 100
Credits: 04 (L-3, T-1 hours/week)

UNIT I

1. General methods of isolation and preliminary phytochemical screening of Alkaloids.

UNIT II

1. Study of the biological source, cultivation, collection, macroscopic, microscopic features, chemical constituents, chemical tests , adulterants, uses, of following group of drugs containing:
    a) Saponins: Liquorice and ginseng.
    b) Cardioactive sterols: Digitalis and strophanthus
    c) Anthraquinone cathartics: Senna, rhubarb.
    d) Others: Gentian and chirata

UNIT III

1. Biological sources, preparation, identification tests and uses of the following enzymes: Diastase, papain, pepsin, and trypsin.
2. Study of natural adaptogens and Immunomodulators.

UNIT IV

1. Introduction to general isolation guide of bio-active agents from crude plants extracts.

UNIT V

1. An introduction to poisonous plants in India.
2. Novel medicinal agents from marine sources.

RECOMMENDED BOOKS:

1. Textbook of Pharmacognosy by C.K.Kokate and D.P.Purohit (Nirali Prakashan, Pune)
2. Trease G.E. and Evans w.e., Pharmacognosy (Baillere Tindall, Eastbourne)
3. Tyler V.E., Brady L.R. and Robbers J.E., Pharmacognosy (Len & Febiger, Philadelphia)
4. Pharmacognosy by T.E. Wallis(CBS Publisher, New Delhi)
5. Staba E.J., Plant Tissue Culture as a source of Bio-medicinals (CRS PRESS Florida, 1980)

PHARMACOGNOSY-III PRACTICAL

Course code: BPH 606 Marks: 100
Credits: 02 (3 hours/ week)

1. Introduction of different extraction process of crude drugs and comparative analysis of their % yields and optimisation.
2. Separation process of bio-active agents of crude drug extracts by chromatographic techniques and solvent fractionation and chemical precipitate techniques.
3. Isolation of Bio-active fractions by column chromatography.

4. Specific identification tests for some crude drugs listed in theory.

PHARMACOLOGY – II

Course code: BPH 607 Marks: 100
Credits: 3 (L-3 hours/week)

UNIT I

1. **Pharmacology of CVS:** General consideration, CHF and Cardiac glycosides, Antihypertensive drugs, Antianginal drugs, Antiarrhythmics, Antihyperlipidemics.

UNIT II

1. **Drugs Acting on Haemopoeitic System:** Haematinics, Vitamin K and haemostatic agents, and anticoagulants, Fibrinolytics and antiplatelet drugs, Plasma Volume expanders
2. **Drugs Acting on Respiratory System:** Anti-asthmatic drugs, Anti-tussives and Expectorants, Respiratory Stimulants

UNIT III

1. **Autacoids:** Histamine, 5HT and their antagonists, Prostaglandins, Thromboxane, Leukotrienes non-steroidal analgesic, anti-inflammatory agents, Angiotensin and Bradykinin

UNIT IV

1. **Drugs acting on GIT:** Antacids and Antiulcer drugs, Laxatives and antidiarrhoeal Agents, Emetics and antiemetics
2. **Drug acting on urinary system**: Diuretics, Antidiuretics.

UNIT V

1. Basic principles of bioassays, radioimmunoassay, enzyme immunoassays, official bioassays of oxytocin, vasopressin, insulin and digitalis. Preclinical toxicity studies.

RECOMMENDED BOOKS:

1. Essentials of Medical Pharmacology by K.D.Tripathy
2. Pharmacology and Pharmacotherapeutic by Sathoskar and Bhandarkar
3. Pharmacology by Prasun K.Das, S.K.Bhattacharya and P.Sen.
4. Text Book of Pharmacology by S.D. Stethi
5. The Pharmacological basis of Therapeutics by Goodman and Gillman
6. Pharmacology by Rang, Dale and Ritter.
7. Basic and Clinical Pharmacology by B.G.Katzung.

PHARMACOLOGY – II PRACTICAL

Course code: BPH 608 Marks: 100
Credits: 02 (3 hours / week)

Experiments on Isolated Preparations; **(Software basis)**

(a) To record the dose response curve (DRC) of acetylcholine using rectus abdominis muscle of frog.
(b) To study the effects of physostigmine and d-tubocurarine on the DRC of acetylcholine using rectus abdominis muscle preparation of frog**.**
(c) To record the DRC of histamine on isolated loop of guinea pig ileum**.**
(d) To calculate the pA2, value of mepyramine or chlorpheniramine using histamine as agonist on isolated loop of guinea pig ileum.

(e) To estimate the strength of the test sample of agonist/drug (e.g. Acetylcholine, Histamine) using a suitable isolated muscle preparation employing matching bioassay, Bracketing assay. Three point assay and four point bioassay.

PHARMACEUTICAL BIOTECHNOLOGY

Course code: BPH 609 Marks: 100
Credits: 03 (L-3 hours/week)

UNIT I

1. **Immunology and Immunological Preparations :** Principles of immunology, antigens, antibodies and haptens, Immune system- cellular and humoral immunity, immunological tolerance, antigen-antibody reactions and their applications, Hypersensitivity, Active and passive immunization, Preparation, standardization and storage of immunological products.

UNIT II

1. **Genetic Code and Protein synthesis:** Genetic code, components of protein synthesis, inhibition of protein synthesis. Brief account of protein engineering and polymerase chain reactions. Regulation of gene expression.
2. **Genetic Recombination :** Gene cloning and its applications. Development of hybridoma for monoclonal antibodies. Study of drugs produced by biotechnology such as Activase, Humulin, Humatrope etc.

UNIT III

1. **Microbial Transformation:** Introduction, types of reactions mediated by micro-organisms, design of biotransformation process, selection of organisms, biotransformation process and its improvements with special reference to steroids.
2. **Antibiotics:** Historical development of antibiotics. Antimicrobial spectrum and methods used for their standardization. Fermenter, its design, control of different parameters. Design of fermentation process, Isolation of fermentation products with special reference to penicillin, streptomycin, tetracycline and vitamin B12.

UNIT IV

1. **Enzyme immobilization:** Techniques of immobilization of enzymes, factors affecting enzyme kinetics, study of enzymes such as hyaluronidase, pencillinase, streptokinase and streptodornase, amylases and proteases etc. Immobilization of bacteria and plant cells.

UNIT V

1. **Blood Products and Plasma Substitutes :** Collection, processing and storage of whole human blood, concentrated human RHCs, dried human plasma, human fibrinogen, human thrombin, human normalimmunoglobulin, human fibrin, foam plasma substitutes, ideal requirements, PVP, dextran etc. for control of blood pressure as per I.P.

RECOMMENDED BOOKS:

1. Industrial Microbiology by Casida.
2. Industrial Microbiology by A.H. Patel.
3. Industrial microbiology by Prescott and Dunn.
4. Pharmaceutical Biotechnology by Vyas and Dixit.
5. Molecularbiology and Genetic Engineering by A.M.Narayanan, A.M.Selvaraj, A.Mani
6. Text Book of Microbiology by Anantanarayana and Panicker.
7. Concepts in Biotechnology by Balasubramanium.
8. Molecular Biotechnology by Glick.
9. Molecular Biotechnology by Gingold.

SEMESTER-VII

PHARMACEUTICS-VI (Biopharmaceutics & Pharmacokinetics)

Course code: BPH 701 Marks: 100
Credits: 4 (L-3, T-1 hours/week)

UNIT I

1. Introduction to Biopharmaceutics and Pharmacokinetics and their role in information development and clinical setting.
2. **Biopharmaceutics:** Biological barrier, Various mechanisms for passage of drugs across biological barrier
   Factors influencing drug absorption-Physicochemical, physiological and pharmaceutical.

UNIT II

1. Drug distribution in the body, plasma protein binding
2. Non-linear Pharmacokinetics – definition, reasons and test to detect non-linearity
3. Metabolism of drugs.
4. **Pharmacokinetics:**
   Different Pharmacokinetic models and their significance.
   Compartment model- Definition and scope.
   Significance of Plasma drug concentration measurement.

UNIT III

1. Pharmacokinetics of drug absorption – Zero order and first order absorption rate constant.
2. Volume of distribution and distribution coefficient.
3. Compartment kinetics – One compartment and two compartment models.
4. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.

UNIT IV

1. Clearance concept, Mechanism of renal clearance, clearance ratio, determination of renal clearance.
2. Extraction ratio, hepatic clearance, biliary excretion, extrahepatic circulation.

UNIT V

1. Bioavailability and bioequivalence:
   Bioavailability (Absolute and Relative), Measures of bioavailability, C_{max}, t_{max} and area under the curve (AUC)
   Bioequivalency and significance of bio-equivalence studies. Design of single dose bioequivalence study and relevant statistics

RECOMMENDED BOOKS:

1. Applied Biopharmaceutics and Pharmacokinetics by Shargel and Yu
2. Biopharmaceutics and Clinical Pharmacokinetics by Notari
3. Biopharmaceutics and Clinical Pharmacokinetics by Gibaldi
4. Biopharmaceutics and Pharmacokinetics by D.M. Brahmankar and Sunil B. Jaiswal
5. Biopharmaceutics and Pharmacokinetics by V. Venkateswarulu.

PHARMACOLOGY – III

Course code: - BPH 702 Marks: 100
Credits: 03 (L-3 hours/week)

UNIT I

1. **Pharmacology of Endocrine System:** Hypothalamic and pituitary hormones, Thyroid hormones and Thyroid Drugs, Parathormone,Calcitonin and Vitamin D, Insulin, oral hypoglycaemic agents and glucagon.

UNIT II

1. ACTH and Corticosteroids, Androgens and anabolic steroids, Estrogens, Progesterone andOral Contraceptives, Drugs acting on uterus.

UNIT III

1. **Chemotherapy:** General Principles of Chemotherapy, Sulfonamides, Cotrimoxazole, Quinolones, Antibiotics-Penicillins, Cephalosporins, Chloramphenicol, Tetracyclines, Macrolides.

UNIT IV

1. Chemotherapy of Parasitic infections, Tuberculosis, Leprosy, Malaria, Fungal infections, Viral diseases, Introduction to Immunomodulators and Chemotherapy of Cancer, Multi-drug resistance.

UNIT V

1. **Principles of Toxicology:** Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphate and atropine poisoning, Heavy metal antagonists

Recommended Books

1. Essentials of Medical Pharmacology by K.D.Tripathy
2. Pharmacology and Pharmacotherapeutic by Sathoskar and Bhandarkar
3. Pharmacology by Prasun K.Das, S.K.Bhattacharya and P.Sen.
4. Text Book of Pharmacology by S.D. Stethi
5. The Pharmacological basis of Therapeutics by Goodman and Gillman
6. Pharmacology by Rang, Dale and Ritter.
7. Basic and Clinical Pharmacology by B.G.Katzung.

PHARMACEUTICAL ANALYSIS-III

Course code: BPH 703 Marks:100
Credits: 04 (L-3, T-1 hours/week)

UNIT I

1. **Ultraviolet and visible spectrophotometry**: Principle, electronic transition and excitation process, basic instrumentation, application in pharmacy.
2. **Fluorimetry**: Principle, types of fluorence, quenching of fluorence, instrumentation and application of fluorimeter.

UNIT II

1. **Infrared spectrophotometry**: Principle, Types of vibration, Finger print region, Instrumentation, absorptions of common functional groups and application of IR.
2. **Nephelometry and turbidimetry:** Basic principle, choice of method, instrumentation and application of the methods

UNIT III

1. **Nuclear magnetic resonance spectroscopy**: An introduction to theory of NMR, magnetic properties of the nuclei, nuclear magnetic movements, chemical shifts, shielding and deshielding, various types of coupling, NMR instrumentation, typical spectra, analytical applications in pharmaceutical analysis.
2. **Mass Spectrometry**: Instrumentation, basic principles, instrumentation, metastable ion, types of peaks, application.

UNIT IV

1. **Column Chromatography:** Basic principle, practical requirements, advantages, disadvantages and application.
2. **High performance liquid chromatography (HPLC)**: Principle, Comparison with column chromatography, types of HPLC techniques, instrumentation, parameters used in HPLC, application.
3. **Gas liquid chromatography**: Principle, criteria for analysis, instrumentation, parameters used in GLC, application.

UNIT V

1. **Thin layer chromatography**: Basic principle, practical requirements, advantages, disadvantages and application (qualitative and quantitative)
2. **High performance layer chromatography (HPTLC)**: Principle, comparison with thin layer chromatography, instrumentation and application.
3. **Paper Chromatography:** Basic principle, practical requirements and application.

RECOMMENDED BOOKS:

1. Svehla, G. Vogel's Text Book of Micro and Semi Micro Qualitative Inorganic Analysis, Orient Longman, Hyderabad.
2. Beckett, A.H. and Stenlake, J.B., Practical Pharmaceutical Chemistry, The Athlone Press of the University of London.
3. Chatten, L.G., Text Book of Pharmaceutical Chemistry, Marcel Dekker, New York.
4. Connors, K,.A., A Text Book of Pharmaceutical Analysis, Wiley Interscience, New York.
5. Higuchi, J. and Hansen E.B., Pharmaceutical Analysis, Interscience Publisher, John Willey and Sons, New York, Sydney.
6. Silverstein,R.M., Bassier, G.C., and Morril,T.C., Spectrophotometric Identification of Organic Compounds, John Wiley and Sons Inc.
7. Willard, Merritt and Settle, Instrumental Methods of Chemical Analysis, CBS Publisher and Distributors, New Delhi.
8. Ewing, G.W., Instrumental Methods of Chemical Analysis.
9. Dyer JR, Applications of absorption spectroscopy of organic compounds, Prentice-Hall of India Pvy. Ltd., New Delhi.
10. Kemp W. Organic Spectroscopy, ELBS, Hongkong.
11. E. Stahl: Thin Layer Chromatography Springer, Verlag, Berlin.

PHARMACEUTICAL ANALYSIS-III PRACTICAL

Course code: BPH 704 Marks: 100
Credits: 02 (3 hours/week)

1. Quantitative estimation of few formulations containing single or more than one drug, using instrumental techniques like UV-Visible spectrophotometry, fluorimetry etc.
2. Chromatographic analysis of some pharmaceutical products, (Paper chromatography of Amino acids, TLC of alkaloids, sulphonamides etc)

3. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS.

PHARMACEUTICAL CHEMISTRY-VI (Chemistry of Natural Products)

Course code: BPH 705 Marks: 100
Credits: 04 (L-3, T-1 hours/week)

UNIT I

Application of I.R., N.M.R. and Mass spectroscopy in the structural elucidation of simple organic compounds.Concept of stereoisomerism taking examples of natural products (Camphor, menthol, Ephedrine, and Atropine).

UNIT II

Cardiac Glycosides: Source, structures, pharmacological properties and study of interrelationship between cardinolides and bufadienolides, Chemistry of digoxin & digitoxin. Introduction to Scillaren A and ouabein.

UNIT III

Vitamins: Classification of vitamins, structural elucidation of vitamin A and Folic acid.
Alkaloids: Classification and general method of isolation of alkaloid, structural elucidation of atropine and ephedrine.

UNIT IV

Antibiotics: Chemistry and therapeutic activity and structural elucidation of penicillin, chemistry of streptomycin.
Flavonoids: Classification of flavonoids, pharmacological properties and chemistry of quercetin.

UNIT V

Terpenes: Classification, General methods of extraction and separation (Mono and sesquiterpenes), special isoprene rule, structural elucidation of citral & camphor.

RECOMMENDED BOOKS:

1. Chemistry of Organic Natural Products (Vol.-1 & 2) by O.P. Agarwal.
2. Organic Chemistry of Natural Products (Vol.-1 & 2) by Gurdeep Chatwal.
3. Organic Chemistry (Vol. 2) by I.L. Finar.
4. Chemistry of Natural Products by Sujata V. Bhat

PHARMACEUTICAL CHEMISTRY-VI (Chemistry of Natural Products) PRACTICAL

Course code: BPH 706 Marks: 100
Credits: 02 (3 hours/week)

1. Analysis of fixed oils including acid value, saponification value, iodine value.
2. Determination of hydroxyl compounds (phenolic and alcoholic).
3. Isolation of active principles from natural sources.
4. Determination of aldehydes and ketones in essential oils.
5. Exercises on paper and thin layer chromatography for evaluations of herbal drug constituents

Elective Subjects

BPH-707 (a): Herbal Drug Technology
BPH-708 (a): Herbal Drug Technology (Practical)
BPH-707 (b): Cheminformatics & Drug Design
BPH 708 (b): Cheminformatics & Drug Design (Practical)
BPH 707 (c): Cosmetic Technology
BPH-708 (c): Cosmetic Technology Practical
BPH-707 (d): Bioassays
BPH-708 (d): Bio Assay Practical

HERBAL DRUG TECHNOLOGY

Course Code: PH 707 (a) Marks: 100
Credits: 03 (L-3 hours/week)

UNIT I

1. Definition of Herbal drug, Advantages of Herbal drug therapy over conventional drugs, Safety, contraindication and Toxicity of Herbal drugs and their interactions.

UNIT II

1. Herbs used as nutraceuticals and cosmeceuticals.
2. Traditional folk medicine from herbs.

UNIT III

1. Development and application of at least two herbal medicines for Inflammatory pain, diabetes, cancer, cardiovascular and neurotic diseases.

UNIT IV

1. Analytical Profiles of selected herbs – Brahmi, Aradrographis paniculata, Withania Somnifera, Turmeric.

UNIT V

1. Quality Control and Quality Assurance of Herbal drugs as per W.H.O. guidelines – Determination of Ash value, Extractable matter, Pesticide residues, heavy metals, moisture content and volatile oil. Analysis of chromatographic fingerprints and marker compounds developments of herbal drugs

RECOMMENDED BOOKS:

1. Trease and Evan's Pharmacognosy 15th Edition (BaillereTindall, Eastbourne)
2. Indian Herbal Pharmacopeia Vol-I and II (Revised New Edition, 2002; Indian Drug Manufacturers' Association, publication).
3. Quality Control methods for medicinal plant material by W.H.O., Geneva.
4. Quality Control of Herbal drugs by Dr. Pulak K. Mukherjee Business Horizons; Reprint 2012 edition 1 May 2002.
5. Botanical safety hand book by Michael Meguffin, Christopher Hobbs published by American Herbal Product Association.
6. Essential of Botanical Extraction by Subhash C Mandal, Vivekananda Mandal and Anup Das, Academic Press (Elsevier) 1st edition, 2015.

HERBAL DRUG TECHNOLOGY PRACTICAL

Course Code: BPH 708 (a)
Credits: 02(3 hours/week)

1. Preparation of plant extracts and their standardization by analytical profiles (any five)
2. Phytochemical screening of crude plant extracts
3. Quality Control tests for raw materials used in Herbal formulations.

CHEMINFORMATICS DRUG DESIGN

Course code: BPH 707 (b) Marks: 100
Credits: 03 (L-3 hours/week)

UNIT I

Principles of Drug Design (Theoretical Aspect), Drug Discovery Pipeline, Physicochemical properties in drug design, Traditional analog design and Bioisosterism

UNIT II

Graph theory, Relationships and nomenclature in graph theory, topological matrices, topological indices and their use in medicinal chemistry

UNIT III

Molecular connectivity, Exposition of connectivity method, Enumeration and evaluation of various chi indices. Brief description of some topological indices: E-state index, kappa shape index, ETA indices

UNIT IV

Objectives and Limitation of Quantitative Structure-activity relationship, QSAR Parameters and QSAR Methods. Statistical quality and validation of QSAR models. Classical quality and validation metrics. Newer approaches: r_m^2 metrics.

UNIT V

Computer Aided Drug Designing and Molecular Modelling, Concept of Pharmacophore Modelling and Ligand based drug design (LBDD), Structure based Drug Design (SBDD)

Recommended Books & Journal

1. C.Hanch, Comprehensive Medicinal Chemistry, Vol. IV, Quantitative Drug Design, Pergamon Press, Oxford, U.K.
2. J. Alvarez, B. Shoichet, Virtual Screening in Drug Discovery. 2005 by CRC Press, Taylor & Francis Group, FL 33487-2742
3. T. Langer and R. D. Hoffmann, Pharmacophores and Pharmacophore Searches. 2006 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany
4. Donald J. Abraham, Burger's Medicinal Chemistry and Drug discovery

5. L B Kier and L H Hall, Molecular connectivity in Chemistry and Drug research, 1976, Academic Press, New York

6. P P Roy, K Roy, On some aspects of variable selection for partial least squares regression models. QSAR & Combinatorial Science 27, 2008, 302-313. doi: 10.1002/qsar.200710043

CHEMINFORMATICS DRUG DESIGN PRACTICAL

Course code: BPH 708 (b) Marks: 100
Credits: 02 (3 Hours/week)

1. Computer aided structural modeling of molecules
2. Ligand based drug design (LBDD), Structure based Drug Design (SBDD)
3. Pharmacophore modeling and virtual screening
4. Statistical methods used in QSAR.
5. Evaluation of various topological indices

COSMETIC TECHNOLOGY

Course Code: BPH 707 (c) Marks: 100
Credits: 03 (L-3 hours/week)

UNIT I

1. Fundamentals of cosmetic technology, classification of cosmetics, A brief study of raw materials used for Cosmetic preparations: surfactants, humectants, cream bases, aerosol propellants, perfumes, colours.

UNIT II

1. Stability aspects of cosmetics: Shelf-life, effects of environmental factors like light, temperatures etc on product stability.
2. Quality control tests of different cosmetic products, Packaging of Cosmetics

UNIT III

1. Hair Care Products: Hair structure, Shampoos, Conditioners, Setting lotion, Hair creams, Hair dyes.

UNIT IV

1. Skin Care Products: Anatomy and physiology of skin, formulation of skin cleaners, moisturizers, sunscreen products, acne products, anti ageing creams.

UNIT V

1. Colour Cosmetics: Introduction, lip colour, nail polish, face make-up eye make-up.
2. Dental products: Dentifrices, Oral rinses, Tooth powder, Tooth paste.
3. Personal Hygiene Products: Shaving creams, after shave products.

RECOMMENDED BOOKS:

1. Cosmetics: Formulation, manufacturing, and Quality control by P.P. Sharma

2. A Handbook of Cosmetics by B.M. Mithal, R.N. Saha
3. The Theory and Practice of Industrial Pharmacy by Lachmann L., Liberman, H.A.
4. Modern Cosmetics by Thomson, E.G.
5. Paucher's Perfumes, cosmetics & soaps by W.A. Paucher.
6. Hary's cosmeticology by J.B.Wilkimsson.

COSMETIC TECHNOLOGY PRACTICAL

Course Code: BPH 708 (c) Marks: 100
Credits: 02 (3 hours/week)

1. Preparation of selected cosmetic preparations representing the following classes:
   a) Shampoos
   b) Hair conditioners
   c) Hair creams
   d) Skin creams
   e) Nail polish
   f) Face powders
   g) Tooth pastes
   h) Tooth powder
   i) Shaving cream
   j) Shaving foam
   k) After shave lotion

2. Evaluation of any two products mentioned above
3. Collection of various packaging materials used for cosmetics and their description (Each student shall collect at least 10 different types of containers.)

BIOASSAYS

Course Code: BPH 707 (d) Marks: 100
Credits: 03 (L-3 hours/week)

UNIT I

1. Definition , principles and design of Bioassays and principle of drug screening. Requirements applications, importance advantages and disadvantages of Bioassays

UNIT II

1. Types of Bioassay (quantal and graded response Bioassys), Bioassay of agonists and antagonists, Determination of pA2 and pD2 value.

UNIT III

1. Biological variation, Biological standardization, Microbiological assay (antibiotics, vitamin B_{12}), Bioassay in Humans

UNIT IV

1. Bioassay of some important drugs like Digitalis, Adrenaline, Noradrenaline, acetylcholine, Histamine, 5-hydroxy tryptamine, d-tubocurarine, Heparin, antibiotics, Vitamin-D,

UNIT V

1. Bioassay of Insulin, Oxytocin, Vassopressin, Growth Hormone, FSH, LH, Prolactin, Thyrotrophin, Corticotrophin, Androgen, Progesterone, Estrogen.

RECOMMENDED BOOKS:

1. Sharma, H.L.; Sharma, K.K. General Pharmacology Basic Concepts
2. Barar, F.S.K. Essentials of Pharmacotherapeutics
3. Rang, H.P.; Dale, M.M.; Ritter, J.M.; Moore, P.K. Pharmacology
4. Satoshkar, R.S.; Bhandarkar, S.D.; Ainapure, S.S. Pharmacology and Pharmacotherapeutics
5. Sharma, V.N. Essentials of Pharmacology
6. Derasari and Gandhi's Elements of Pharmacology
7. Remington's Pharmaceutical Sciences
8. Indian Pharmacopeia
9. Pillai, K.K. Experimental Pharmacology
10. Kulkarni, S.K. Hand Book of Experimental Pharmacology

BIOASSAYS PRACTICAL

Course Code: BPH 708 (d) Marks: 100
Credits: 02 (03 hours/week)

(*In-vitro* Experiments on Software basis recommended where use of animals are restricted)

1. To find out the strength of the given sample of acetylcholine by comparative bioassay using rectus abdominis muscle of frog.
2. To find out the strength of the given sample of acetylcholine by interpolation bioassay using rectus abdominis muscle of frog.
3. To find out the strength of the given sample of acetylcholine by three-point bioassay using rectus abdominis muscle of frog.
4. To find out the strength of the given sample of acetylcholine by four-point bioassay using rectus abdominis muscle of frog.
5. To find out the strength of the given sample of d-tubocurarine by graphical bioassay using rectus abdominis muscle of frog.
6. To find out the strength of the given sample of acetylcholine by four-point bioassay using guinea pig ileum.
7. To find out the strength of the given sample of histamine by four-point bioassay using guinea pig ileum.
8. To find out the strength of the given sample of oxytocin by four-point bioassay using rat uterus.
9. To find out the strength of the given sample of 5-hydroxy tryptamine by four-point bioassay using rat fundus.
10. To find out the strength of the given sample of 5-hydroxy tryptamine by comparative bioassay using rat fundus.

SEMESTER VIII

PHARMACEUTICS-VII (Pharmaceutical Technology III)

Course Code: BPH 801 Marks: 100
Credits: 04 (L-3, T-1 hours/week)

UNIT I

1. **Preformulation studies: Principal areas like**

a) Bulk Characterization: Crystallinity and Polymorphism, hygroscopicity, bulk density, powder flow properties.
b) Solubility analysis: pKa, pH solubility profile, Common ionic effect, thermal effects, solubilization, partition coefficient and dissolution.

UNIT II

1. **Sustained release formulations:** Concept, Rationale for Extended – Release Pharmaceuticals, Terminology, Techniques of Extended– Release oral dosage forms, Delayed - Release oral dosage forms
2. Design and evaluation of transdermal drug delivery systems.

UNIT III

1. Controlled release dosage forms: Concept and rationale, Dissolution-Controlled systems, Diffusion-Controlled systems, Combination dissolution and diffusion systems, Osmotically controlled systems, Ion-Exchange Systems

UNIT IV

1. **Targeted drug delivery:** Concept of drug targeting, importance in therapeutics, methods in drug targeting, basic concepts of liposomes, nanoparticles, resealed erythrocytes, implants, IUDs and ocuserts.

UNIT V

1. **Cosmetics**: Fundamentals of cosmetic science, Formulation, preparation and packaging of cosmetics like anti-perspirants & deodorants, creams, lotions, shampoos, hair conditioners & dyes, nail polish and lipsticks. Special formulation considerations for baby care products.

RECOMMENDED BOOKS:

1. The Theory and Practice of Industrial Pharmacy by Lachmann, Libermann and Kanig
2. Pharmaceutical Dosage Forms and Drug Delivery Systems by Ansel, Allen and Popovich
3. Remington: The Science and Practice of Pharmacy, 20th Edition
4. Pharmaceutics: The Science of Dosage Form Design by Aulton
5. Bentley's Textbook of pharmaceutics edited by E.A. Rawlins
6. Modern Pharmaceutics:, G.S. Banker and C.T. Rhodes, Marcel Dekker Inc., NY

PHARMACEUTICS-VII (Pharmaceutical Technology III) PRACTICAL

Course Code: BPH 802 Marks: 100
Credits: 04 (6 hours / week)

1. Solubility enhancement by different techniques (at least 2).
2. Dissolution testing and data evaluation for oral solid dosage forms.
3. Determination of pharmacokinetic parameters from the given plasma drug concentration – time and urinary excretion data.
4. Preparation (at least 6) and evaluation (at least 2) of cosmetic products

PHARMACEUTICAL CHEMISTRY - VI (Medicinal Chemistry – III)

Course code: BPH 803 Marks: 100
Credits: 04 (L-3, T-1 hours/week)

UNIT -I

1. Theoretical aspect of rational drug design: Traditional analogue, quantitative structure activity relationship (QSAR) and mechanism based approaches.
2. The drug development process. An introduction to Classical QSAR: Free Wilson Model; LFER Model.
3. A brief introduction to graph theory and topological structure representation.

UNIT-II

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

1. **Sulphonamides** : Sulphadiazine, Sulphamethoxazole, Sulphacetamide
2. **Antibiotics**: General study including classification: Ampicillin, Amoxycillin, tetracyclines, cephalexin, Doxycycline and Chloramphenicol
3. **Antifungal agents**: Ketoconazole, Clotriamazole, 5-Flucytosine

UNIT–III

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class.

1. **Anti Malarial Drugs**: Chloroquine, Pamaquine, Proguanil, Quinacrine.
2. **Anthelmentics** : Mebendazole, Albendazole, Diethyl Carbamazine.
3. **Antiamoebic agents**: Metronidazole Diloxamide furoate

UNIT –IV

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class

1. **Antineoplastic agents**: Chlorambucil, Thiotepa, Busulfan, Mechlorethamine
2. **Anti-TB and anti-leprosy Drugs**: Isoniazid, Eltambutrol, Pirazinamide, Dapsone
3. **Anti-viral including anti-HIV agents**; Acyclovir, Zidovudine, Nevirapine,

UNIT-V

Classification, mode of action, uses and structure activity relationship of the following classes of drugs. Synthesis of those compounds only exemplified against each class

1. **Quinolone Antibacterials**: Ofloxacin, Nalidixic Acid
2. **Thyroid and Anti thyroid drugs**: Diiodotyrosine, Levothyronine, Propythiouracil, Carbimazole
3. **Diagnostic Agents**: Fluorescein sodium, Bentiromide, Diatrizoic Acid

BOOKS RECOMMENDED

- Foye, W.C. “Principles of Medicinal Chemistry” Lea and Febiger, Philadelphia
- Wilson and Giswold’s “Textbook of Organic, Medicinal and Pharmaceutical Chemistry” J. Lippincott Co., Philadelphia.
- Burger’s Medicinal Chemistry, John Wiley and Sons, Newyark
- D Sriram, P Yogeeswari, Medicinal Chemistry, Pearson, Delhi
- A Kar, Medicinal Chemistry, New Age International (P) Ltd Publishers, New Delhi

CLINICAL PHARMACY AND DRUG INTERACTIONS

Course Code: BPH 804 Marks: 100
Credits: 03 (L-3 hours / week)

UNIT I

1. **Introduction to clinical pharmacy:** Definition, development and scope

2. **Patient data analysis:**The patient's case history, its structure and use in evaluation of drug therapy, Communicationskills including patient medication history interview, patient counseling. Hematological, Liverfunction, renal function, Tests associated with cardiac disorders. Adverse drug reaction-Epidemiology, Classification, Risk factors, Monitoring a detecting adverse drug reactions,Assessing causality, Reporting adverse drug reactions.

UNIT II

1. **Daily activities of clinical pharmacist:** Drug therapy monitoring (Medication chart view, clinical review**,** TDMandpharmacistinterventions. Drug utilization evaluation (DUE) and review (DRU). Quality assurance of clinicalPharmacy services, Prescription auditing and medication errors and monitoring.

UNIT III

1. **Clinical Pharmacokinetics:** Physiological determinants of drug clearance and volumes of distribution. Renal and non-renalclearance. Estimation and determinants of bioavailability. Calculation of loading and maintenancedoses. Dose adjustment in renal failure, hepatic dysfunction, geriatric and paediatric patients.

UNIT IV

1. Concept of essential drugs and rational use of drugs
2. **Definition, symptoms, classifications of the disease, treatment and parameters to monitorthe therapy of following systems/diseases**
   a) Cardiovascular systems-hypertension, congestive cardiac failure, ischemic heart disease
   b) Renal system-acute and chronic renal failure
   c) GI diseases

UNIT V

1. **Research design and conduct of clinical trials:**Research supportincluding planning and execution of clinical trials. Guidelines for good clinical research practiceand ethical requirements. Various phases of clinical trials. Categories of Phase IV studies.

RECOMMENDED BOOKS:

1. Remington the Science and Practice of Pharmacy
2. Clinical Pharmacology by Laurence, Bennett and Brown
3. Medical diagnosis and treatment by Tierney, Mc phee and Papadakis
4. Clinical Pharmacy & Therapeutics by Roger Walker, Edwards.
5. Clinical Pharmacy and Therapeutics by Herfindal, Gourley and Lloyd Hart.
6. Physiological basis of Medical Practice by John B. West
7. Drug Interactions by Ivan Stockley

QUALITY ASSURANCE

Course Code: BPH 805 Marks: 100
Credits: 04 (L-3, T-1 hours / week)

UNIT I

1. Drug Regulatory Affairs: Role of Regulatory Affairs Dept, Nomenclature and salient features of regulatory authorities of India, US, Japan and EU.

UNIT II

1. Good Manufacturing practices: GMP, cGMP, GCP, GLP,

UNIT III

1. Pharmaceutical Validation: Validation of Water systems for sterile & Non Sterile products, cleaning validation, process validation, Equipment validation, Analytical method validation.

UNIT IV

1. Quality Assurance with reference to organization, personnel, Building & facility equipment, Product Control, ware housing, Returned goods & reprocessing, Documentation.

UNIT V

1. Clinical Trials
2. Introduction to SOP, TQM, ISO and IPR.
3. Stability testing protocols of drug products as per ICH guidelines.

RECOMMENDED BOOKS:

1. Pharmaceutical Process Validations – Ira R. Berry, Robert A. Nash
2. GMP – P.P. Sharma
3. Quality Assurance Manual – D.H. Shab – Business Hortzons
4. Quality Assurance for Pharmaceuticals – Vol-I&II-Pharma Book Syndicate
5. SOP Guidelines – D.H. Shab – Business Horizons

PHARMACEUTICAL MANAGEMENT

Course Code: BPH 806 Marks: 100
Credits: 03 (L-3 hours / week)

UNIT I

1. **Concept of Management:** Administrative management (Planning, Organizing, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/Morale). Principles of Management (Co-ordination, Communication, Motivation, Decision-making, leadership, innovation, creativity, delegation of authority/responsibility and record keeping) Identification of Key points to give maximum thrust for development and perfection.

UNIT II

1. **Accountancy:** Principles of accountancy, Ledger posting and book entries, Preparation of trial balance, columns of a cash book, bank reconciliation statement, rectification of errors, profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of checks, bills of exchange, promissory notes and hundies, documentary bills.

UNIT III

1. **Pharmaceutical Marketing:** Function, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.
2. **Salesmanship:** Principles of sales promotion, advertising, ethics of sales, merchandising, literature & detailing. Recruitment, training, evaluation and compensation to the pharmacist.

UNIT IV

1. **Materials management:** A brief exposure to the basic principles of materials management, purchase, stores & inventory control and evaluation of materials management.
2. **Production Management:** A brief exposure of the different aspects of production management (Visible & Invisible) inputs, methodology of activities, performance evaluation techniques, process-flow, process know-how and maintenance management.

UNIT V

1. **Market research:**

a) Measuring & Forecasting Market Demands-Major concept in demand measurement, Estimating current demand, Geodemographic analysis, Estimating industry sales, Market share & Future demand.
b) Market Segmentation & Market Targeting.

2. **Economics:** Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labour welfare, general principles of insurance, inland and foreign trade, procedure of exporting and importing goods.

.

BPH 807: PROJECT WORK

BPH 808: COMPREHENSIVE VIVA-VOCE