Department of Pharmaceutical Sciences

TEACHING LOAD and SCHEME OF EXAMINATIONS FOR THEORY AND PRACTICAL PAPERS
FOR B.PHARMACY COURSE w.e.f. 2014-15

B. Pharm. I st Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the subject</th>
<th>Theory (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Ast.)</th>
<th>Practicals (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Ast.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPH-1.1</td>
<td>Pharmaceutics I (General Pharmacy)</td>
<td>4</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-1.2</td>
<td>Pharmaceutical Chemistry I (Inorganic Chem.)</td>
<td>4</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-1.3</td>
<td>Pharmacology I (Anatomy &amp; Physiology)</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-1.4</td>
<td>Remedial Biology *</td>
<td>4*</td>
<td>100*</td>
<td>4*</td>
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</tr>
<tr>
<td>Total</td>
<td></td>
<td>18</td>
<td>300</td>
<td>22</td>
<td>300</td>
</tr>
</tbody>
</table>

Total = 40 hrs / week in I st Semester;
* Only for PCM candidates; qualifying paper only; marks not to be counted for merit.
Total marks in I st Semester = 600

B. Pharm. II nd Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the subject</th>
<th>Theory (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Ast.)</th>
<th>Practicals (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Ast.)</th>
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</thead>
<tbody>
<tr>
<td>BPH-2.1</td>
<td>Pharmaceutics II (Dispensing Pharmacy and Hospital Pharmacy)</td>
<td>4</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-2.2</td>
<td>Pharmaceutical Chemistry II (Organic chemistry)</td>
<td>5</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-2.3</td>
<td>Pharmacognosy I</td>
<td>4</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-2.4</td>
<td>Pharmaceutical Chemistry III (Physical Chemistry)</td>
<td>3</td>
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<td>100</td>
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<tr>
<td>Total</td>
<td></td>
<td>16</td>
<td>400</td>
<td>24</td>
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</tbody>
</table>

Total = 40 hrs / week in II nd Semester; Total marks in II nd Semester = 800

B. Pharm. III rd Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the subject</th>
<th>Theory (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Ast.)</th>
<th>Practicals (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Ast.)</th>
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</thead>
<tbody>
<tr>
<td>BPH-3.1</td>
<td>Pharmaceutics III (Pharmaceutical Engineering I)</td>
<td>6</td>
<td>100</td>
<td>6 (Engg. Drwg.)</td>
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</tr>
<tr>
<td>BPH-3.2</td>
<td>Pharmaceutical Chemistry IV (Pharm. Biochemistry)</td>
<td>4</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-3.3</td>
<td>Pharmacognosy II</td>
<td>4</td>
<td>100</td>
<td>6</td>
<td>100</td>
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<tr>
<td>BPH-3.4</td>
<td>Pharmaceutical Chemistry V (Heterocyclic and bioorganic chemistry)</td>
<td>4</td>
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<tr>
<td>BPH-3.5</td>
<td>Environmental Studies</td>
<td>4</td>
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<tr>
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<td>22</td>
<td>400</td>
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<td>300</td>
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Total = 40 hrs / week in III rd Semester; * Qualifying paper only; marks not to be counted for merit. Total marks in III rd Semester = 700
B. Pharm. IV th Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the subject</th>
<th>Theory (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Asst.)</th>
<th>Practical (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Asst.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPH-4.1</td>
<td>Pharmaceutical Chemistry VI (Anal. Chem I)</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-4.2</td>
<td>Pharmaceutics IV (Pharmaceutical Microbiology)</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-4.3</td>
<td>Computer Sciences</td>
<td>4</td>
<td>100</td>
<td>6</td>
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<tr>
<td>BPH-4.4</td>
<td>Pharmaceutical Mathematics and Statistics</td>
<td>6</td>
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<tr>
<td>Total</td>
<td></td>
<td>22</td>
<td>400</td>
<td>18</td>
<td>400</td>
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Total = 40 hrs / week in IV th Semester; Total marks in IVth Semester = 800

B. Pharm. V th Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the subject</th>
<th>Theory (hrs)</th>
<th>Marks 80(Main)+ 20 (Int. Asst.)</th>
<th>Practical (hrs)</th>
<th>Marks 80 (Main)+ 20 (Int. Asst.)</th>
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</thead>
<tbody>
<tr>
<td>BPH-5.1</td>
<td>Pharmaceutics V (Physical Pharmacy)</td>
<td>4</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-5.2</td>
<td>Pharmaceutical Chemistry VII (Medicinal Chemistry I)</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-5.3</td>
<td>Pharmaceutics VI (Pharmaceutical Engineering II)</td>
<td>4</td>
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<td>100</td>
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<tr>
<td>BPH-5.4</td>
<td>Pharmacology II (Pathophysiology)</td>
<td>4</td>
<td>100</td>
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</tr>
<tr>
<td>BPH-5.5</td>
<td>Pharmaceutics VII (Pharmaceutical Management)</td>
<td>4</td>
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<tr>
<td>Total</td>
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</table>

Total = 40 hrs / week in V th Semester; Total marks in Vth Semester = 800

B. Pharm. VI th Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the subject</th>
<th>Theory (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Asst.)</th>
<th>Practical (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Asst.)</th>
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</thead>
<tbody>
<tr>
<td>BPH-6.1</td>
<td>Pharmaceutics VIII (Dosage Form Design)</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-6.2</td>
<td>Pharmacology III</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-6.3</td>
<td>Pharmacognosy III</td>
<td>4</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-6.4</td>
<td>Pharmaceutics IX (Forensic Pharmacy)</td>
<td>6</td>
<td>100</td>
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<tr>
<td>Total</td>
<td></td>
<td>22</td>
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<td>18</td>
<td>300</td>
</tr>
</tbody>
</table>

Total = 40 hrs / week in VI th Semester; Total marks in VIth Semester = 700
### B. Pharm. VII th Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the subject</th>
<th>Theory (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Ast.)</th>
<th>Practical (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Ast.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPH-7.1</td>
<td>Pharmaceutics X (Pharmaceutical Technology)</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-7.2</td>
<td>Pharmaceutical Chemistry VIII ( Anal. Chem. II )</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-7.3</td>
<td>Pharmacognosy IV</td>
<td>5</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-7.4</td>
<td>Pharmacology IV (Pharmaceutical Biotechnology)</td>
<td>5</td>
<td>100</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>22</strong></td>
<td><strong>400</strong></td>
<td><strong>18</strong></td>
<td><strong>300</strong></td>
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</tbody>
</table>

Total = 40 hrs / week in VII th Semester; Total marks in VIIth Semester = 700

### B. Pharm. VIII th Semester

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Name of the subject</th>
<th>Theory (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Ast.)</th>
<th>Practical (hrs)</th>
<th>Marks 80(Main)+ 20 (Int.Ast.)</th>
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</thead>
<tbody>
<tr>
<td>BPH-8.1</td>
<td>Pharmaceutical Chemistry IX (Medicinal chemistry II)</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-8.2</td>
<td>Pharmacology V</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-8.3</td>
<td>Pharmaceutics XII ( Biopharmaceutics )</td>
<td>6</td>
<td>100</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>BPH-8.4</td>
<td>Pharmaceutics XIII (Pharmaceutical Packaging)</td>
<td>4</td>
<td>100</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>22</strong></td>
<td><strong>400</strong></td>
<td><strong>18</strong></td>
<td><strong>300</strong></td>
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</tbody>
</table>

Total = 40 hrs / week in VIII th Semester; Total marks in VIIIth Semester = 700

### Total Marks

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Semester</th>
<th>Total Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1st Semester</td>
<td>600</td>
</tr>
<tr>
<td>2</td>
<td>2nd Semester</td>
<td>800</td>
</tr>
<tr>
<td>3</td>
<td>3rd Semester</td>
<td>700</td>
</tr>
<tr>
<td>4</td>
<td>4th Semester</td>
<td>700</td>
</tr>
<tr>
<td>5</td>
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<tr>
<td>7</td>
<td>7th Semester</td>
<td>700</td>
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<tr>
<td>8</td>
<td>8th Semester</td>
<td>700</td>
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<tr>
<td></td>
<td><strong>Grand Total</strong></td>
<td><strong>5700</strong></td>
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</tbody>
</table>
Note:
1. There shall be 80 marks for Main Theory / Practical Examinations and 20 marks for Internal Assessment, in all theory / practical papers. For Internal Assessment, the “Rules for award of Internal Assessment for UG courses”, as applicable from time to time, shall be implemented.
2. The distribution of marks for Main Theory Examination (80 marks) shall be as follows:

<table>
<thead>
<tr>
<th>Question</th>
<th>Coverage</th>
<th>Marks Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question One</td>
<td>Covering the entire syllabus</td>
<td>Short answer type questions</td>
</tr>
<tr>
<td>Question Two</td>
<td>Covering the Unit One</td>
<td>Any one question, out of two questions, need to be answered</td>
</tr>
<tr>
<td>Question Three</td>
<td>Covering the Unit Two</td>
<td>Any one question, out of two questions, need to be answered</td>
</tr>
<tr>
<td>Question Four</td>
<td>Covering the Unit Three</td>
<td>Any one question, out of two questions, need to be answered</td>
</tr>
<tr>
<td>Question Five</td>
<td>Covering the Unit Four</td>
<td>Any one question, out of two questions, need to be answered</td>
</tr>
</tbody>
</table>
Department of Pharmaceutical Sciences  
Revised syllabus w.e.f. 2014-15 academic session  

B.PHARM. 1ST SEMESTER  

BPH – 1.1 PHARMACEUTICS I (General Pharmacy)  

THEORY  

Lectures = 4 hrs / week  

Unit-I  

1. Extraction: Various methods of extraction of crude drugs namely percolation (various types including processes for concentrated preparations, constant hot percolation), maceration (various types including processes for organized and unorganized drugs, for concentrated preparations, double and triple maceration processes), Decoction. Formulation, preparation and uses of various Formulation, preparation and uses of pharmaceutical extracts  

Unit-II  

2. Liquid Preparations: Formulation, preparation and uses of various liquid products namely syrups, aracmatic waters, spirits, solutions, mucilages, elixirs, glycerins, mouthwashes, gargles, nasal drops, ear drops.  


Unit-III  


5. Surgical dressings: like fibres, fabrics, bandages, surgical ligatures and sutures i.e. catgut and other absorbable and non-absorbable products. Quality control of surgical dressings  

Unit-IV  

6. Immunology: General introduction, infection, factors influencing infection, kinds of immunity, vaccines (i.e. Tetanus vaccine, Diptheria vaccine, BCG vaccine, small pox vaccine), virus immunity, toxoids, toxins, daignostic preparation, sera, antitoxins (i.e. Dipheria antitoxins, Botulinium antitoxins), brief control of immunological products-identification tests, toxicity tests, sterility tests, potency tests and storage of immunological products.  


PRACTICALS: ( 6 hrs / week )  

Number of practicals based on aforementioned theory portion and including preparation of the following:  
Peppermint water, cinnamon water, camphor water, chloroform water, concentrated peppermint water, concentrated cinnamon water, simple syrup, syrup of ginger, syrup of orange, syrup of tolu, compound syrup of ferrous sulphate, spirit of peppermint, spirit of chloroform, spirit of ether, strong solution of ammonium acetate, surgical solution of chlorinated soda, solution of cresol with soap, solution of ferric chloride, strong solution of iodine, solution of hydrogen peroxide, tannic acid glycerin, boric acid glycerin.mouth washes,nasal drops, ear drops, elixirs, mucilage of acacia, mucilage of tragacanth, tincture of orange, capsicum tincture, tincture of lemon, tincture of tolu, tincture of nuxvomica, liquid extract of liquorice,liquid extract of ipecacuanha, liquid extract of belladona, liquid extract of senna, concentrated infusion of clove, concentrated infusion of quassia, concentrated infusion of senna, liver extract.  

List of Books Recommended  

Text Books  

Reference Books.  
4. “Pharmacopoeia of India”, Published by the Controller of Publications, Delhi  
BPH-1.2  PHARMACEUTICAL CHEMISTRY I  (Inorganic Chemistry)

THEORY

Unit I
An outline of the methods of preparation, uses, sources of impurities, tests for purity and identity, including the limit test for iron, lead, heavy metals, chloride, sulphate and special tests if any, of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia monograph details.


Unit II
Essential and trace elements: transition elements and their compounds of pharmaceutical importance: iron and haematinics, mineral supplements. Cationic and anionic compounds of inorganic drug useful for systemic effects. Topical agents: protectives, astringents and anti-infectives.

Unit III
Gases and vapours: oxygen, anesthetics and respiratory stimulants. Dental products: dentifrices, anti-caries agent. Complexing and chelating agents used in therapy- theoretical consideration and official products (calcium disodium edetate, disodium edetate, dimercaprol and penicillamine). Miscellaneous agents: sclerosing agents, expectorants, emetics, sedatives etc. Pharmaceutical aids used in pharmaceutical industry: antioxidants, preservatives, filter aids, adsorbents, diluents, excipients, suspending agents, colorants etc.

Unit IV
Inorganic radiopharmaceuticals: nuclear radiopharmaceuticals, reactions, nomenclature, methods of obtaining their standards and units of activity, measurement of activity, clinical applications and dosage, hazards and precautions. Inorganic toxicology: sources of toxic inorganics, individual metal toxicities – aluminium, arsenic, barium, lead, lithium, manganese, mercury. toxic anions-cyanide; antidotes- sodium nitrite, sodium thiosulphate, activated charcoal and light kaolin.

PRACTICALS

A number of practicals based on aforementioned theory including the followings:

1. Limit tests for impurities in pharmacopoeial compounds.
2. Quantitative analysis-assay of the following compounds: Boric acid, Solution of ammonia, sodium bicarbonate, sodium chloride, calcium hydroxide.
3. The background and systemic qualitative analysis of inorganic mixtures up to 4 radicals. Six mixtures to be analyzed, preferably by semi-micro methods.
4. To carry out identification tests for calamine, boric acid, hydrogen peroxide.

List of Books Recommended

Text Books


Reference Books

3. "Pharmacopoeia of India", Govt. of India, Ministry of Health
5. **Lymph and lymphatic system**: Composition, formulation and circulation of lymph, disorders of lymph and lymphatic system, basic physiology and functions of spleen.

6. **Respiratory system**: Anatomy of respiratory organs, functions of respiration mechanism and regulation of respiration, respiratory volumes and vital capacity.

**Unit II**

7. **Cardiovascular system**: Basic anatomy of heart, physiology of heart, blood vessels and circulation. Basic understanding of cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation, Brief outline of cardiovascular disorders like hypertension, hypotension, arteriosclerosis, angina, myocardial infarction, congestive heart failure and cardiac arrhythmias.

8. **Digestive system**: Gross anatomy of the gastrointestinal tract, function of its different parts including those of liver, pancreas and gallbladder, various gastrointestinal secretions and their role in the absorption and digestion of food.

9. **Autonomic nervous system**: Physiology and functions of the autonomic nervous system. Mechanism of neurohumoral transmission in the autonomic nervous system.

10. **Central nervous system**: Functions of different parts of brain and spinal chord. Neurohumoral transmission in the central nervous system, reflux action, electroencephalogram, specialized functions of the brain, cranial nerves and their functions.

**Unit III**

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

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

13. **Reproductive system**: Male and female reproductive systems and their hormones, physiology of menstruation, coitus and fertilization. Sex differentiation, spermatogenesis and oogenesis. Pregnancy its maintenance and parturition.

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

**Unit IV**

15. **Health Education**: 
   A. Classification of food requirements, balance diet, nutritional deficiency disorders, their treatment and prevention, specification of drinking water.
   B. Demography and family planning: Demography cycle, family planning, and various contraceptive methods. Medical termination of pregnancy.
   C. Brief outline of communicable diseases, their causative agents, modes of transmission and prevention (chicken pox, influenza, diphtheria, cough, tuberculosis, poliomyelitis, hepatitis, cholera, typhoid, food poisoning, helminthiasis, malaria, filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhea and AIDS).
   D. First aid: emergency treatment of shock, snakebites, burns, poisoning, fractures and resuscitation methods.

**PRACTICALS**

1. Study of human skeleton.
2. Study of different systems with the help of charts and models.
3. Microscopic study of different tissues.
5. Recording of body temperature, pulse rate and blood pressure, basic understanding of electrocardiogram-PQRST waves and their significance.
7. Physiological experiments on nerve-muscle preparations.
8. Determinations of vital capacity, experiments on spirometry.

**List of Books Recommended**

**Text Books**


**Reference Books**

5. “Samson Wright’s Applied Physiology”, Oxford University Press.
BPH-1.4  REMEDIAL BIOLOGY

THEORY  

Lectures: 4 hrs./week.

Unit-I
1. Cell: Definition of cell, different types of cell, structure, importance of different non-living inclusions. Different process of division of cell like amitosis, mitosis, meiosis and their significance.
2. Histology of Plants: Tissue system, Different types of plant tissues (meristematic and mature/complex) and their functions. Histology of root, stem, bark, wood, leaf, flower and seed.

Unit-II
3. Classification of plant: Different methods of classification plants like artificial and natural with their merit and demerit. Distinguished features of spore bearing and seed bearing plant with example.

Unit-III
5. Classification of animals: Definition of taxonomy, and general outline of the classification of animal kingdom.
6. Vertebrates: Fundamental characters of the vertebrates with special emphasis on the class like amphibians, reptiles, aves and mammals.

Unit-IV

PRACTICALS  

(4 hrs. / week)

1. Morphology of plant parts and their modifications as indicated in theory.
2. Care, use and type of microscope.
3. Study of different phases of division of cell by permanent slides
4. Preparation, microscopic examination of dicot and monocot stem, root and leaf.
5. Study of structure and distinguished features of vertebrates and invertebrates as mentioned in theory with the help of specimen.

List of Books Recommended

Text Books
B.PHARM. 2nd SEMESTER

BPH-2.1 PHARMACEUTICS II (Dispensing and Hospital Pharmacy)

THEORY

UNIT-I
1. Definitions and General Dispensing Procedures.
3. Sources of error and care required in dispensing prescriptions.
5. Types of Dispensed products.
6. Containers, closures and labelling for dispensed products.
7. Colours, flavours, sweeteners and other additives used in prescriptions.

UNIT -II
8. Principles involved and procedures adopted in dispensing of typical preparations like mixtures, emulsion, creams, ointments, powders, pastes, jellies, suppositories, ophthalmics, pastilles, lozenges, pills, lotions, liniments, inhalations, paints, sprays etc.

UNIT -III
10. Pharmaceutical Calculations- percentage solutions, enlarging and reducing recipes, calculation of doses, alligation, alcohol dilutions, proof spirit, isotonic solutions, milli-equivalents, displacement value etc.

UNIT -IV
11. Hospital and its organisation:
   a) Pharmacy, organisation and personnel
   b) Hospital formulary
   c) Purchasing and inventory control
   d) Drug distribution
   e) Dispensing to inpatients
   f) Dispensing to outpatients
   g) Drug charges
   h) Pre-packaging
   i) Central sterile supply
   j) Drug information centre
   k) Maintenance of records
   l) Safe use of medicines

PRACTICALS: (6 hrs/week)
Number of practicals based on aforementioned theory portion but including dispensing of preparations like emulsions, suspensions, solutions, creams, ointments, inhalations, liniments, paints, syrups, mixtures, pastes etc.

List of Books Recommended
Text Books

Reference Books
5. William E Hassan, “Hospital Pharmacy”, Lea & Febiger, Philadelphia

Revised syllabus w.e.f. 2014-15 session 9
BPH – 2.2 PHARMACEUTICAL CHEMISTRY II (Organic Chemistry)

THEORY Lectures: 5 Hrs/week

Unit I
Structure and Properties: Atomic structure; atomic orbitals, molecular orbital theory, wave equations, molecular orbital, bonding and anti-bonding orbitals, electronic configuration of some molecules, covalent bonds, hybrid orbitals, intermolecular forces, bond dissociation energy, polarity of bonds, polarity of molecules, structural and physical properties, intermolecular forces, acids and bases, isomerism.

Unit II
Stereochemistry: introduction, optical activity, stereoisomerism, specifications of configuration, reactions involving stereoisomers. Stereoselective and Stereospecific reactions.
Factors affecting electron availability:
  a. Inductive effects,
  b. Resonance effects,
  c. Hyper conjugation,
  d. Steric effects,
  e. Application of these factors on the strength of acids and bases Bond length,
  f. Tautomerism.

Unit III
Structure, Nomenclature, preparation and reactions of alkanes, alkenes, alkynes, cycloalkanes, dienes, benzene, polynuclear aromatic compounds, arenes, alkyl halides, alcohols, ether epoxides, amines, phenols, aldehydes and ketones, carboxylic acids, functional derivatives of carboxylic acid, carbanions, aldol condensation, claisen condensation, malonic esters and acetoacetic ester synthesis.

Unit IV
Nucleophilic aromatic substitutions: α,β-unsaturated carbonyl compounds. Electrocyclic reactions, sigmatropic reactions, neighbouring group effects. Catalysis by transition metal complexes.

PRACTICALS  (6 hrs / week )
1. Synthesis of selected organic compounds.
2. Introduction to the use of stereomodels.
3. Identification of organic compounds and their derivatisations.
4. Synthesis of Aspirin, Phenyl benzoate, Iodoform, Nitrobenzene, Trichloroacetic acid, Phthamide, Osazone, Paraformaldehyde

List of Books Recommended
Text Books
Reference Books

BPH – 2.3 PHARMACOGNOSY I

THEORY Lectures: 4 Hrs/week

Unit-I
1. Definition, history, development and scope of Pharmacognosy.
2. Sources of drugs: biological, marine, geographical and plant tissue cultures as sources of drugs.
3. Classification of drugs alphabetical, morphological, taxonomical, pharmacological, chemical and chemotaxonomical with their merits and demerits.
4. Adulteration of crude drugs, detection by morphological and microscopical methods by covering by determination of leaf constants, lycopodium spore method. Micrometers and measurement of microscopic characters. Techniques in microscopy; Details of mountants, clearing agents, chemomicroscopic reagents.

Revised syllabus w.e.f. 2014-15 session
Unit-II
5. Study of the following families with special reference to medicinally important plants- (at least three examples)-
   Apocynaceae, Solanaceae, Rutaceae, Umbelliferae, Leguminosae, Rubiaceae, Liliaceae, Labiate.
   `-Cultivation, collection, processing and storage of crude drugs: factors influencing cultivation of
   medicinal plants, fertilizers of common use, pest management and natural pest control agents. Plant
   hormones and their applications, polyploidy, mutation and hybridization with reference to medicinal
   plants.
6. Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin, and natural colorants.

Unit-III
7. An introduction to active constituents (Carbohydrates, lipids, phenolics, alkaloids, volatile oils and
   resins) of drugs: their isolation, classification and properties.
8. Systematic Pharmacognostical study of the following: (A.) Carbohydrates and derived products: Agar,
   Guar gum, Gum acacia, Honey, Isabgol, Pectin, Starch and Tragacanth. (B.) Lipids: Bees wax, Castor
   oil, Cod liver oil, Linseed oil, Shark liver oil and Wool fat.

Unit-IV
9. Study of drugs containing resins and resin combinations: Podophyllum, Capsicum, Myrrh, Asafoetida,
   Balsam of tolu, Benzoin, Turmeric and Ginger.
10. Volatile oil: General methods of obtaining volatile oils from plants, study of volatile oils of Mentha,
    Coriander, Cinnamon, Lemon peel, Orange peel, Lemon grass, Caraway, Cumin, Dill, Spearmint, Clove,
    Fennel, Nutmeg, Eucalyptus, Cardamom, Valerian, Palmarosa, Gauetheria, Sandal wood.

PRACTICALS
Practical exercises based on aforementioned theory including the following:
1. Morphological characteristics of plant families mentioned in theory.
2. Microscopic measurements of cells and cell contents and determination of leaf constants.
3. Morphological and microscopical study of crude drugs mentioned in theory.
4. Chemical examination for the identification of crude drugs mentioned in theory.

List of Recommended Books
5. Mohammad Ali, "Text Book of Pharmacognosy"
6. Shah and Quadry, "Pharmacognosy".
9. Jean Brunton, “Text Book of Pharmacognosy, Phytochemistry and Medicinal Plants”, Intercept Limited,
   Andover, England, U.K.

BPH – 2.4
(Physical Chemistry)

THEORY
Lectures: 3 Hrs/week

Unit I
Behaviour of gases: kinetic theory of gases, deviation from ideal behaviours and explanation. The liquid state:
Physical properties (Parachor, refractive index, optical rotation, dipole moments and chemical constituents).
Solutions: Ideal and real solutions, solutions of gases in liquids, colligative properties, partitions coefficient,
conductance and its measurement, Debye huckel theory. Thermodynamics; first, second and third laws, zero law,
absolute temperature scale, thermochemical equations, phase equilibrium and phase rule.

Unit II
Adsorption: Frudlich and Gibbs adsorption isotherms, Langmuir theory of adsorption. Photochemistry:
Consequences of light absorption, Jablenski diagram, Lambert-Beer law, Quantum efficiency. Chemical Kinetics:
Zero, first and second order reactions, complex reaction, theories of chemical kinetics, characteristics of
homogeneous and heterogeneous catalysis, acid base and enzyme catalysis. Quantum mechanics: Postulates of
quantum mechanics, operators in quantum mechanics, and the Schordinger wave equation.

Unit III
Solution of electrolytes: Arrhenius theory of electrolytic dissociation, modern theory of strong electrolytes, and
other coefficients for expressing colligative properties. Ionic equilibria; Ostwalds dilution law, Lawry Bronsted and
Lewis theory of acids and bases, ionization constants of weak acids and bases, ionic product of water.

Unit IV

Revised syllabus w.e.f. 2014-15 session 11
**Electrochemistry**: The electric cell, electrode potential, half cells, types of half cells, sign convention, Nernst equation, the salt bridge, activity series, standard potential, standard hydrogen electrode, measuring the relative voltage of half cells, calculations of standard potential, reference electrodes, indicator electrodes.

A. **Potentiometry**: theoretical considerations, ion-selective electrodes, measurement of potential, location of end point equipment, analytical application, direct measurement of a metal concentration, differential curve, determination of ksp, pH measurement dead stop titrations; pH meter, pH definition, relation to pH to potential, equipment and applications.

B. Conductance and high frequency titrations and their applications.

C. Coulometric titrations, its principles and applications, controlled potential coulometry, cell design, instrumentation, advantages and limitations, and electrode selection.

D. Polarography and its applications: theory of mass transport processes, current processes, current potential relationship, polarization, choice of electrodes, effect of oxygen, instrumentation, calculation of concentration, laboratory design and safety.

E. Amperometric titrations and its applications.

**PRACTICALS**

1. To determine the molecular mass of naphthalene by Rast’s method.
2. To determine the specific reaction rate of the acid catalysed hydrolysis of ethyl acetate.
3. To determine the specific reaction rate of the hydrolysis of ethyl acetate by sodium hydroxide.
4. To determine the partition coefficient of iodine between CC14 and water.
5. To study the molecular state of benzoic acid in benzene by partition method.
6. To study the phase diagram of a two component system having eutectic temperature (diphenylamine-naphthalene).
7. To draw the mutual solubility curve of phenol water system.
8. To measure the surface tension of solutions of any alcohol in water at different concentrations.
9. To study the adsorption of acetic acid on activated charcoal.
10. To determine the heat of neutralization of HCl and NaOH.
11. To determine the heat of combustion of naphthalene at constant pressure and temperature.

**List of Books Recommended**

**Text Books**

**Reference Books**

Revised syllabus w.e.f. 2014-15 session 12
B.PHARM. 3rd SEMESTER

BPH – 3.1 PHARMACEUTICS III (Pharmaceutical Engineering I)

THEORY

UNIT – I

1. **Flow of fluids**: Introduction, mechanism of fluid flow, Reynolds number and its significance, Bernoulli’s theorem, manometers and friction losses in pipes, measurement of flow rate using direct weighing or measuring, hydrodynamic methods, displacement meters and dilution methods. Regulation of flow using plug cocks, globe valves, automatic regulating valve, butterfly valve and diaphragm valve, and water hammer.

2. **Refrigeration**: Principle and equipment employed for vapor compression refrigeration, lithium bromide absorption refrigeration and steam jet refrigeration. Applications of refrigeration in Pharmacy

UNIT – II

3. **Heat Transfer**: Modes of heat transfer, Fourier’s law, overall heat transfer coefficient, Stefan-Boltzman's law, single pass heater, multipass heater, liquid-liquid heat interchanger and finned tubes.

4. **Drying**: Theory, behaviour of solids during drying, static bed dryers, moving bed dryers, fluidised bed dryer and pneumatic bed dryers.

UNIT – III

5. **Size reduction**: Mechanism, factors influencing, energy requirements, applications in pharmacy, grinders i.e. fluid energy mill, hammer mill, ball mill and its variants, centrifugal mill, attrition mill, edge runner mill, colloid mill, squirrel cage disintegrator, Buhlerstone mill.

6. **Centrifugation**: theory, industrial centrifugal filters and industrial centrifugal sedimenters.

7. **Filtration**: Theory, filter aids, filter media, industrial filters i.e. sand filter, washing and non-washing type filter presses, rotary drum filter, leaf filters, edge filter.

UNIT – IV

8. **Evaporation**: Factors affecting evaporation, natural circulation evaporators e.g. evaporating pan, evaporating still, horizontal and vertical tube evaporators, forced circulation evaporators, film evaporators, multiple effect evaporation, material and energy balance of evaporators.

9. **Humidification, dehumidification and air conditioning**: Principles of Humidification, dehumidification and air conditioning, psychrometry, humidity measurement, large-scale equipment for humidification and dehumidification, cooling towers.

List of Books Recommended

**Text Book**


**Reference Books**


**PRACTICALS**

(Pharmaceutical Engineering Drawing)

1. **Introduction**: Significance of Engineering Drawing in Pharmaceutical Industry, drawing instruments and their uses, lines, lettering and dimensioning.

2. **Scales**: Construction of plain scales, vernier scale, diagonal scale, comparative scale and isometric scale.


4. **Orthographic projections**: Theory, types, and construction of drawing in both first angle and third angle. Various methods of sectioning i.e. full section, half section, removed section, partial section, and offset section.

5. **Conversion of orthographic projections into isometric projections/views**

6. **Drawing of machine parts and simple pharmaceutical equipment**

7. **Methods of depicting layouts of various sections of a pharmaceutical unit**

List of Books Recommended

**Text Books**

2. N. D. Bhatt, “Engineering Drawing”

Revised syllabus w.e.f. 2014-15 session 13
**BPH – 3.2**  
**PHARMACEUTICAL CHEMISTRY IV**  
(Pharmaceutical Biochemistry)

**THEORY**  
Lectures: 4 Hrs/week

**Unit I**  

**Unit II**  
Enzymes: classification of enzymes, general mechanism of enzyme function, factors affecting the velocity of enzyme catalysed reaction, activators and inactivators of enzymatic reaction. Clinical application of enzyme estimation. Isoenzyme, immobilization of enzymes.

**Unit III**  
Metabolism of carbohydrates: an aerobic metabolism of glucose, aerobic metabolism of glucose (Kreb’s cycle) pentose phosphate pathway, metabolism of galactos, glycosynthesis, glycogenolysis, gluconeogenesis, regulation of blood glucose concentration.  
Metabolism of proteins; nitrogen fixation, nitrogen balance, ammonia assimilation, nitrification and nitrate assimilation, amino acid degradation and urea cycle. Metabolism of phenyl-alanine and tryptaphan.

**Unit IV**  
Metabolism of purines and pyrimidines: biosynthesis of RNA and DNA. Role of cyclic nucleotide in enzyme activation. Gene protein relationship, control of protein synthesis. Mutation, physical and chemical mutagenesis repair mechanism, recombinant DNA technology, genetic code inborn error of metabolism. Biochemical role of trace elements

**PRACTICALS**  
(6 hrs/week)

1. Preparation of standard buffer (nitrate, phosphate, carbonate and measurement of pH).  
2. Quantitative estimation of proteins.  
3. Estimation of blood glucose, blood cholesterol, SGPT and SGOT activity.  
4. Acid hydrolysis and action of salivary amylase on starch.  
5. Estimation of chloride, glucose, ammonia and creatinine in urine.  
7. Identification of abnormal constituents of urine.

**List of Books Recommended**

**Text Books**

**Reference Books**

**BPH – 3.3**  
**PHARMACOGNOSY-II**

**THEORY**  
Total Lectures: 4 Hrs/week

**Section-A**
1. Phytochemical screening: (a) Preparation of extracts. (b) Chemical and chromatographic methods of screening for alkaloids, glycosides, resins, tannins, saponins and flavonoids in plant extracts.  
2. Study of the biological sources, cultivation, collection, commercial verities, chemical constituents, substituents, adulterants, diagnostic microscopic and macroscopic features and specific chemical tests of following group of Glycosides containing drugs:
   a. Saponins: liquorice, ginseng, dioscora and senega.
   b. Cardio-active sterols: digitalis, squill, strophanthus and thevetia.  
   c. Anthraquinones : aloe, senna, rhubarb and cascara.
Section-B
3. Study of Tannins and tannin containing drugs like gambir, black catechu, gall and myrobalan.
4. Studies of traditional drugs, common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses and marketed formulations of following indigenous drugs:
   Amla, Shatavari, Apamarg, Gokhru, Shankhpushpi, Gaduchi, Brahmi, Arjuna, Methi, Lehsun, Guggal, Gymnema and Neem.
5. Holistic concepts of Drugs administration in traditional systems of medicine:
   Introduction to ayurvedic preparations like arishtas, asavas, gutikas, tailas, churnas, lehas and bhasmas.

Section-C
6. Systematic study of source, cultivation, collection, processing, commercial verities, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following alkaloid containing drugs:
   (a) Pyridine-piperidine: tobacco, areca and lobelia.
   (b) Tropane: belladonna, hyoscyamus, datura and withania.
   (c) Quinoline and isoquinoline: Cinchona, ippecac, opium.
   (d) Indole: ergot, raawolfia, catharanthus and physostigma.
   (e) Imidazoles: pilocarpus.
   (f) Steroidal: vertrum, kurchi.
   (g) Alkaloidal amines: ephedra and colchicum.
   (h) Glycoalkaloids: solanum.
   (i) Purines: Coffee, tea and cola.

Section-D
7. Introduction and study of plant bitters and sweeteners.
8. Plant based pesticides and insecticides.
9. Study of fibers used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.

PRACTICALS
1. Phytochemical screening of secondary plant metabolites listed as above in theory portion.
2. Morphological, microscopical and chemical evaluation of crude drugs as mentioned above.

List of Recommended Books

BPH – 3.4 PHARMACEUTICAL CHEMISTRY V
(Heterocyclic and Bio-Organic Chemistry)

THEORY

Lectures: 4 Hrs/week

Unit I

Unit II
Carbohydrates: An account of the Classification, chemistry, linkageand biological activity of Glucose, Sucrose, Structure elucidation of glucose, sucrose.
Study of chemistry of fixed oils, fats and waxes.
Classification, Chemistry and biological activity of vitamins.
Polymers- Classification, Synthesis, reactions, crystallinity, polymer degradation mechanism, copolymerization and their applications in Pharmacy.
Unit III
Proteins and Amino Acids: Isolation and general methods of synthesis of amino acids and physico-chemical properties. General classification of proteins and end group analysis. Structural features of DNA and RNA.

Unit IV
Terpenes: Classification, Isoprene rule, Chemistry of various constituents of volatile oils: Limonene, Pinene, Cineole, Camphor, Menthol, Menthone, Thymol, Citral and Eugenol. Structure elucidation of Pinene, Limonene, Camphor, Citral. Glycosides: Chemistry of salicin, cardiac glycosides, anthraquinone glycosides, saponins. and cardiac glycosides.
Fullerenes- Introduction, chemical reactions and applications

List of Books Recommended
Text Books

Reference Books

BPH – 3.5 ENVIORNMENTAL STUDIES
Lectures: 4 Hrs/week

Unit-I
1. The Multidisciplinary Nature of Environmental Studies
Definition, scope and importance
Need for public awareness
2. Natural Resources
Renewable and non-renewable resources:
Natural resources and associated problems
(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.
(c) Mineral resources: Use and over-exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
(f) Land resources: Land as a resource, land degradation man induced land slides, soil erosion and desertification.
   • Role of an individual in conservation of natural resources.
   • Equitable use of resources foe sustainable life styles.

Unit-II
3. Ecosystems
• Concept of an ecosystem.
• Structure and function of an ecosystem.
• Producers, consumers and decomposers.
• Energy flow in the ecosystem
• Ecological succession
• Food chains, food webs and ecological pyramids.
• Introduction, types, characteristic features, structure and function of the following ecosystem:
  (a) Forest ecosystem
  (b) Grassland ecosystem
  (c) Desert ecosystem
4. Biodiversity and its Conservation
- Introduction - Definition: genetic, species and ecosystem diversity.
- Biogeographical classification of India.
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- Biodiversity at global, national and local levels.
- India as a mega-diversity nation.
- Hot-spots of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India.
- Conservation of biodiversity: *In-situ* and *Ex-situ* conservation of biodiversity.

5. Environmental Pollution
Definition
- Causes, effects and measures of
  (a) Air pollution
  (b) Water pollution
  (c) Soil pollution
  (d) Marine pollution
  (e) Noise pollution
  (f) Thermal pollution
  (g) Nuclear hazards
- Solid waste management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquakes, cyclone and landslides.

6. Human Population and Environment
- Population growth, variation among nations.
- Population explosion - Family Welfare Programme.
- Environment and human health.
- Human rights.
- Value education.
- HIV/AIDS.
- Women and Child Welfare.
- Pole of Information Technology in Environment and human health.
- Case studies.

7. Social Issues and the Environment
- From Unsustainable to Sustainable development.
- Urban problems related to energy.
- Water conservation, rain water harvesting, water shed management.
- Environmental ethics: Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of Pollution) Act.
- Water (Prevention and Control of Pollution) Act.
- Wildlife Protection Act.
- Forest Conservation Act.
- Issues involved in enforcement of environmental legislation.
- Public awareness.

Field Work
- Visit to a local area to document environmental assets - river, forest, grassland/hill/mountain.
- Visit to a local polluted site - Urban/ Rural/ Industrial/ Agricultural.
- Study of common plants, insects and birds.
- Study of simple ecosystems - pond, river, hill slopes etc.
B.PHARM. 4TH SEMESTER
BPH-4.1 PHARMACEUTICAL CHEMISTRY VI
(Analytical Chemistry I)

THEORY

Lectures: 6 hrs / week

Unit I
Introduction: Significance of quantitative analysis in quality control, different techniques of analysis, preliminaries and definitions, significant figures, rules for retaining significant digits, types of errors, mean deviation and standard deviation, statistical treatment of small data sheets, selection of sample, precision and accuracy, fundamentals of volumetric analysis, method of expressing concentration, primary and secondary standards. Acid Base Titrations: acid base concepts, role of solvent, relative strength of acids and bases, ionisation law, law of mass action, common ion effect, ionic product of water, neutralization curves, acid-base indicators, theory of indicators, choice of indicators, mixed indicators, application in assay of H3PO4, NaOH, CaCO3 etc.

Unit II

Unit III

Unit IV
Miscellaneous method of analysis; Diazotisation titration, Kjeldahl nitrogen determination, Karl fishcher titration, determination of alcohol in liquid galenicals, oxygen flask combustion, gasometry. Extraction procedure, separation of drug from excipients, liquid-liquid extraction, separation of mixtures by extraction, distribution law, successive extraction, the Craig method of multiple extraction, continuous counter-current extraction, effect of temperature.

PRACTICALS:
( 6 hrs / week )

2. Preparation and standardization of volumetric solutions and assay of official compounds involving Acidimetry, Alkalimetry, Permanganometry, Ceriometry, Iodimetry, Iodometry, Gravimetry and Complexometry.
3. Any other practical based in afore mentioned theory

List of Books Recommended

Text Books

Reference Books
7. Lunn G. “Handbook of Derivatisation Reaction for HPLC”

Revised syllabus w.e.f. 2014-15 session 18
BPH-4.2 PHARMACEUTICS IV  (Pharmaceutical Microbiology)

THEORY

Lectures: 6 hrs / week

Unit I
1. Introduction to the science of microbiology-ancient theories concerning the origin of life, contribution of great scientists to this science, with particular reference to the contributions of the following scientists: A.V. Leeuwenhoek, Louis Pasteur, Edward Jenner, Robert Koch, Alexander Fleming, Joseph Lister.
2. Microscopy: Microscopes, their magnification, resolution, illumination and filters, working of different types of microscopes, micrometry.

Unit II
3. Classification of microbes and their taxonomy.
5. Bacterial enzymes – classification, nomenclature, production by fermentation, extraction methods, immobilization techniques and applications of bacterial enzymes in general and detailed account of following bacterial enzymes: alpha amylase (diastase) and proteases.

Unit III
6. Disinfection, factors affecting disinfection, dynamics of disinfection, disinfectants and antiseptics and their evaluation.
7. Sterilization, different methods, applications and evaluation of sterilization methods.
8. Aseptic technique.

Unit IV
9. Microbial standardisation of antibiotics ( ampicillin, streptomycin ), Vitamins ( Vitamin B-12, Niacin ) and calcium pentothenate.
10. Fermentation: Types of media used; factors affecting, control of various parameters during fermentation. A detailed account of the industrial fermentation process for manufacture of penicillin, streptomycin, glutamic acid; Lysine, citric acid, Vit.B₁₂. [6]

PRACTICALS: ( 6 hrs / week )
Number of experiments based upon afore mentioned theory and including experiments devised to prepare various types of culture media, subculturing of common aerobic and anaerobic bacteria, fungi and yeast, various staining methods, various methods of isolation and identification of microbes, sterilizing techniques and evaluation of sterilizing techniques, evaluation of aseptics and disinfectants, testing and sterility of pharmaceutical products as per I.P. requirements, evaluation of potency of antibiotics and vitamins etc.

List of Books Recommended

Text Books
1. L. E. Casida, “Industrial Microbiology”, New Age International (P) Ltd. New
2. Pelczar, Chan and Krieg, “Microbiology”.

Reference Books
5. G Sykes, “Disinfection and Sterilization”.
6. Davis, Dulbetco, Eisen “Microbiology”.

BPH-4.3 COMPUTER SCIENCES

THEORY

Lectures: 4 hrs / week

Unit I
1. Introduction: Importance of computers, history of computers (generations), types of computers, classification of computers, components of a computer, applications of computers including Pharmaceutical applications, hardware description, Languages like assembly, machine, and common high-level languages, computer viruses.
2. Introduction to Internet: Concepts of Internet, WWW, Gopher, e-mail and applications of Internet. [5]

Unit-2
1. Programming in BASIC: Introduction to BASIC, flowcharting, BASIC statements, constants and variables, expressions in BASIC, print control, jumping and looping, subscripted variables, functioning and subroutines, histogram and graphs, programme design, file management in BASIC and computer graphics.
Unit -3
1. Introduction to operating system with a special emphasis on Windows.
2. MS-Word- Introduction to Word processing, Introduction to MS word, Editing, formatting., previewing and printing a document, advanced features of MS word (Find and replace, grammar and spelling, auto correct, word count, mail merge, table and charts).

Unit-4
1. MS- excel- Worksheet basics, creating, formatting, previewing and printing a worksheet, graphs and charts, working with formulas and cell referencing, database creation, sorting, database functions (Mathematical and trigonometrical, statistical and logical functions).
2. MS-PowerPoint- Features and various versions, creating presentations, working with different views and menus of PowerPoint, editing and formatting a text, working with slides, printing a presentation, inserting objects, slide sorter and animation effects.

PRACTICALS: ( 6 hrs / week )
Number of experiments based on aforementioned theory.

BPH-4.4 PHARMACEUTICAL MATHEMATICS AND STATISTICS

THEORY
Lectures: 6 hrs / week

Unit-I
Matrices and Determinants: definition of matrix, types of matrices, arithmetic operations on matrices, determinants and its expansion, important properties of determinants, solutions of simultaneous equations by Cramer's rule.
Differentiation: Concepts of functions, limits and differentiation; differentiation of standard functions (without using first principle), including function of a function (chain rule), differentiation of implicit functions, logarithmic differentiation, parametric differentiation, elements of successive differentiation.

Unit-II
Integration: integration as inverse of differentiation, indefinite integrals of standard functions, integration- by parts and substitution methods, formal evaluation of definite integrals.
Differential equations: definition, formation and solution of ordinary differential equations of first order and first degree (variable separable technique only).
Laplace transforms: definition, properties of linearity and shifting, transforms of elementary function (without proof) and inverse Laplace transforms not involving Euler's theorem.

Unit-III
Measures of central tendency and dispersion: requisites of an ideal measure, arithmetic mean, median, mode, range, mean deviation, standard deviation, coefficients of variation.
Linear correlation: bi-variate data, scatter diagrams, correlation, types of correlation, Karl Pearson's and Spearman's methods, coefficients of correlation and its important properties (without proof).
Linear regression: regression, method of least squares, lines of regression, regression coefficients and their important properties (without proof).

Unit-IV
Probability: events, classical and statistical definitions of probabilities, addition and multiplication laws of probability, conditional probability, Baye’s theorem (statement only) and its applications.
Standard probability distribution: definitions, important properties (without proof) and applications of binomial, Poisson and normal distribution/ normal curves. Central limit theorem (statement only).
Statistical inference: concepts of parameter, statistic, sampling distribution, standard error, hypothesis, type-I and type-II errors; testing of hypothesis, t- test (paired and unpaired),Z-test(for means only).
Note:- Emphasis on Pharmaceutical applications, wherever possible, of the above-mentioned concepts and results(without proof).

Recommended Text Books:
# B.PHARM. 5TH SEMESTER

**BPH – 5.1 PHARMACEUTICS V** (Physical Pharmacy)

<table>
<thead>
<tr>
<th>THEORY</th>
<th>Lectures: 4 hrs / week</th>
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<tbody>
<tr>
<td>UNIT-I</td>
<td></td>
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| 1. Matter- State and selected properties: State of matter, change in the state of matter, latent heats and vapour pressure, sublimation-critical point, eutectic mixtures, relative humidity, liquid complexes, liquid crystals, glassy state, solid-crystalline and amorphous polymorphism.  
2. Micromeretic and Powder Rheology: Particle size and distribution, average particle size, number and weight distribution, particle number, method of determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods of determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness and flow properties. |
| 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, electric properties of interface.  
2. Viscosity and Rheology: Newtonian systems, laws of flow, kinematic viscosity, effect of temperature, non Newtonian systems, pseudoplastic, dilatent, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling ball, rotational viscometers. |
| UNIT-III |                         |
| 1. Dispersion system  
Colloidal dispersions: Definition, types, properties of colloids, protective colloids, applications of colloid in pharmacy. Suspensions and Emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, emulsions; types, theories and physical stability.  
2. Complexation: Classification of complexes, method of preparation and analysis, application. |
| UNIT-IV |                         |

**PRACTICALS:** 6hrs/week

Number of experiments based upon aforementioned theory and including the following:

1. Determination of latent heat, vapour pressure and critical point.  
2. Studies on polymorphs, their identification and properties.  
3. Determination of particle size, particle size distribution and surface areas using various methods of particle size analysis.  
4. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.  
5. Determination of surface/interfacial tension, HLB values and critical micellar concentration of surfactants.  
6. Study of rheological properties of various types of systems using different viscometers.  
7. Studies of different types of colloid and their properties.  
8. Preparation of various types of suspensions and determination of their sedimentation parameters.  
10. Studies on different types of complexes and determination of their stability constants.  
11. Determinations of half-life rate constant and order of reaction.  
12. To study the influence of various factors on the rate of reaction.  

**List of Books Recommended**

<table>
<thead>
<tr>
<th>Text Books</th>
<th>Reference Books</th>
</tr>
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Revised syllabus w.e.f. 2014-15 session 21
BPH – 5.2

PHARMACEUTICAL CHEMISTRY VII
(Medicinal Chemistry I)

THEORY

Lectures: 6 hrs / week

UNIT-I

Basic Principles of Medicinal Chemistry: Physio-chemical aspects of Drug action: Stereochemical aspects of drug action (Optical, geometric and bioisosterism of drug molecules with biological action), conformational isomerism, solubility and partition coefficient, chemical bonding. Drug-receptor interactions: receptor concept, receptor- effector theories, types of receptor and their action including transduction mechanism and G proteins.

UNIT-II

Mode of action, uses, Structure activity relationship including physiochemical properties of the following classes of drugs. Drugs acting at Synaptic and neuro-effector junction sites: Cholinergics and anticholinergics, antispasmodics, antiulcer drugs, ganglionic stimulants, Neuromuscular blocking agents, sympathomimetic agents including biosynthesis of adrenergic neurotransmitter, adrenergic drugs and adrenoceptor blockers. Autocoids: Antihistamines, Ecosanoids, Anti-inflammatory agents, Anti-inflammation agents (nonsteroidal), analgesic and antipyretics.

UNIT-III

Diuretics and Antidiuretics. Cardiovascular agents: Antihypertensives, Cardiotonics, Antiarrhythmics, antianginal, antiplatelets and antiplatelet agents, thrombolytics, antithrombolytics, hypolipoproteinimic drugs. Vitamins: Classification, chemistry of thiamine, pyridoxine, folic acid, ascorbic acid and vitamin A. Insulin and oral hypoglycemic agents. Thyroid and Antithyroid drugs. Oxytocics including oxytocin, ergot alkaloids and prostaglandins.

UNIT-IV

Synthetic procedures of the following selected drugs – Neostigmine bromide, Cyclopentolate HCl, Propantheline bromide, Benzhexol, Diphenhydramine, Chlorpheneramine, Promethazine, Cyclazine, Sodium chromoglycollate, Aspirin, Ibuprofen, Indomehtacin, Phenzone, Phenylbutazone, Oxyphenebutazone, Allopurinol, Probenecid, Furosemide, Acetazolamide, Chlorthiazide, Hydrochlorothiazide, Spironolactone, Triamterene, Naproxen, Procainamide, Verapamil, Propanalol, Methyldopa, Cionidine, Guanethidin, Hydralazine, Phenylamine, Clofibrate, Warfarin, Phenindione, Pyridoxine, Folic acid, Tolbutamide, Methylthiouracil, methimazole.

PRACTICALS

(6 hrs / week)

Synthesis of following compounds
1. Hippuric acid
2. 1-phenyl-azo-Z-naphthol
3. Picric acid
4. Sodium benzenesulphonate
5. Mannich reaction
6. Succinic anhydride
7. Methyl benzoate
8. Benzimidazole
9. oxalic acid
10. Hexamethylenetetramine
11. Acetene oxide

List of Books Recommended

Text Books

Reference Books
5. Exploring QSAR

Revised syllabus w.e.f. 2014-15 session 22
BPH – 5.3  PHARMACEUTICS VI  (Pharmaceutical Engineering II)

THEORY

Lectures: 4 hrs / week

UNIT-I
1. Distillation: Raoult's law, volatility, boiling point diagrams, azeotropic mixtures, equilibrium diagrams, types of distillation, rectification, rectifying columns, downcomers, material and energy balance of a rectifying column, reflux ratio, determination of number of theory plates, H.E.T.P. and steam distillation.
2. Extraction: Factors affecting, equipment for extraction of solids i.e. fixed bed diffusion battery, continuous diffusion battery, basket extractor, Rotocel extractor and Dorr agitator; equipment for liquid-liquid extraction i.e. extraction towers and Podbielniak extractor.

UNIT- II
4. Size separation: Screening equipment i.e. trommels, rotex and hummer; air suspension methods i.e. air separator and cyclone separators; hydraulic separation i.e. elutriation and double cone emulsifier.

UNIT- III
5. Crystallization: crystal forms, habit, Mier's supersaturation theory, crystallizers based on supersaturation, by cooling (i.e. tank crystallizers, agitated batch crystallizers and Swenson-Walker), adiabatic cooling (i.e. vacuum crystallizers) and evaporation (i.e. Krystal crystallizers). Material and energy balance of crystallizer
6. Transportation of materials:
   Liquids: Pumps i.e. airlift, ejector, piston plunger, egg, diaphragm, gear, screw, centrifugal and self-priming.
   Gases: Ejectors, compressors, fans and blowers.
   Solids: Intermittent and continuous methods in vertical, horizontal and inclined plane.

UNIT- IV
7. Materials for pharmaceutical plant construction: factors affecting the selection of a material for pharmaceutical plant, ferrous metals (i.e. cast iron, steel and stainless steels), nonferrous metals (i.e. Copper and its alloys, aluminium, tin silver, nickel and alloys), nonmetals i.e. glass, slate, asbestos, rubber, plastics and timber.
8. Industrial hazards and safety precautions: Mechanical-chemical-electrical-fire-dust hazards, safety requirements, accident records etc.

PRACTICALS  6hrs/week
Numbers of practical based on theory portions of Pharmaceutical Engineering-I and Pharmaceutical Engineering-II and including the following:
1. To perform Reynold's experiment.
2. Determination of fanning factor.
3. Comparison of the sensitivity of various manometers.
4. Determination of flow rate using venturimeter
5. Determination of flow rate using orificemeter
6. Determination of overall heat transfer coefficient.
7. Effect of number of balls on the grinding rate in a ball mill.
8. Efficiency of a centrifugal pump.
11. Overall efficiency of steam distillation.
12. Use of psychrometric chart.
14. Determination of equilibrium moisture constant.

List of Books Recommended

Text Books

Reference Books
BPH – 5.4 PHARMACOLOGY II (Pathophysiology)

THEORY

Lectures: 4 hrs / week

Unit I
1. Pathophysiology of hypo- & hyper-secretion of endocrine glands & their disorders e.g. Diabetes mellitus.
2. Pathophysiology of anaemia, hypersensitivity, allergic conditions.
3. Pathophysiology of Asthma, Pneumonia, Bronchitis, Emphysema.
4. Pathophysiology of joints disorders – Arthritis, gout, myasthenia gravis, spasticity, tetany, fatigue.
5. Pathophysiology of cataract, glaucoma etc.

Unit II
6. Pathophysiology of psychosis, epilepsy, depression, Parkinson's & Alzheimer's diseases.
7. 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 III
9. Pathophysiology of hypertension, angina, CHF, myocardial infarction, cardiac arrhythmias, ischemic heart disease, arteriosclerosis.
11. Pathophysiology of tuberculosis, leprosy, malaria, influenza, chicken pox, tetanus, helminthisis, filariasis.

Unit IV
12. Pathophysiology of sexually transmitted diseases, spermatogenesis, oogenesis.
13. Pathophysiology of syphilis, gonorrhea and AIDS.

BPH – 5.5 PHARMACEUTICS VII (Pharmaceutical Management)

THEORY

Lectures: 4 hrs / week

UNIT-I

UNIT- II
3. Pharmaceutical Marketing Functions Buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business. [5]

UNIT-III

UNIT-IV
7. Production Management: [5] A brief exposure of the different aspects of production management, Production planning and control, Plant location, Plant layout and material handling, inspection and maintenance of plant facilities.

List of Books Recommended

Text Books

Reference Books
B.PHARM. 6TH SEMESTER

BPH – 6.1 PHARMACEUTICS VIII (Dosage Form Design)

THEORY

Lectures: 6 hrs / week

Unit - I

1. Routes of Drug Administration
2. Types of Dosage Forms and Delivery Systems
3. New Drug Approval Process
4. Preformulation studies:
   a) Study of the following physical properties of drugs and their effect on formulation, stability and bioavailability:
      Physical form, Particle size, shape and surface area, Density, Wetting, Dielectric constant, Solubility, Dissolution, and Organoleptic properties.
   b) Study of the following chemical properties of drugs and their influence on formulation and stability of products like:
      - Hydrolysis, oxidation, reduction, racemization, polymerization.
   c) Pharmacological factors (Biological factors)

Unit - II

5. Theory, Industrial Production, SOPs, Packaging, Labeling and Quality Control (official and other methods) of:
   - Syrups
   - Suspensions
   - Emulsions
   - Ointments
   - Stabilization and Stability Testing Protocols for the above mentioned pharmaceutical products.
   Schedule ‘P’ and ICH Guidelines on Stability.

6. Prodrugs: Types and approaches to make prodrugs. Role of prodrugs in solving problems related to formulation development, stability and bioavailability.


Unit - III

8. Nomenclature of Cosmetic Ingredients
10. Water in Cosmetics
11. Naturals in Cosmetics (Botanical, Animal, Milk and Minerals)
12. Colors in Cosmetics
13. Perfumes and Fragrances in Cosmetics
14. Preservatives in Cosmetics and Microbiological control of Cosmetics.

   Formulation, preparation and quality control of the following colored cosmetics:
   -- Lipsticks and Lip salves, Nail lacquers and Eye Cosmetics

Unit – IV

15. Structure and functions of Hair, Teeth and Skin. Types of skin glands and skin secretions and physiology of sweating.

   Formulation, preparation and quality control of the following cosmetics:
   -- Tooth powders and Tooth paste
   -- Antiperspirants and Deodorants
   -- Creams -- Cold cream and Cleansing cream, Vanishing cream, Sunscreen cream, Foundation cream, Moisturizing cream
   -- Hair cosmetics -- Shampoos, Hair creams and fixers, Hair Colorants and Dyes,
   -- Depilatories, Shaving creams and After Shave Lotion.
   -- Astringents and Skin Tonics

PRACTICALS

( lectures = 06 hrs per week)

- Preformulation studies including drug-excipient compatibility studies, effect of stabilizers, preservatives etc. in dosage form design.
- Experiments to illustrate comparative study of Suspending Agents, Emulsifying agents, Preservatives and Antioxidants.
- Formulation, preparation, packing, labeling and evaluation of the following class of dosage forms using laboratory scale equipments- Syrups (including dry syrups), Suspensions, Emulsions and Topical Preparations.
• Synthesis and characterization of some **Prodrugs**
• Stability evaluation of various dosage forms and determination of their shelf life.
• Preparation and evaluation of (a) Cold cream (b) Vanishing cream (c) Sunscreen cream (d) Hair creams (e) Shampoos (f) Shaving cream (g) Tooth powder (h) Tooth paste (i) Mouth wash (j) Lipsticks etc. as per BIS or other methods
• Any other experiments illustrative of the portion covered in the theory portion of the syllabus.

**Books Recommended**

2. Remington's Practice of Pharmacy
3. SOP by Shah
4. Modern Pharmaceutics-Banker and Rhodes
5. Encyclopedia of Pharmaceutical Technology – Swarbrick
6. Indian Pharmacopoeia
13. Harry's Cosmetology

**BPH – 6.2  PHARMACOLOGY III**

**THEORY**

**Lectures: 6 hrs / week**

**Unit-I**

1. **General pharmacology:**
   a. Introduction to pharmacology, sources of drugs, dosage forms and routes of administration, mechanism of action, combined effect of drugs, factors modifying drug action, tolerance and dependence, pharmacogenetics.
   b. Absorption, distribution, metabolism and excretion of drugs, principles of basic and clinical pharmacokinetics, adverse drug reactions and treatment of poisoning, ADME drug reactions, bioassay of drugs and biological standardization, discovery and development of new drugs.

2. **Pharmacology of autonomic nervous system:**
   a. Neurohumoral transmission (autonomic and somatic)
   b. Parasympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics, Ganglion blocking and Stimulating agents
   c. Neuromuscular blocking agents.
   d. Local anaesthetic agents.

3. **Pharmacology of Central Nervous System:**
   a. Neurohumoral transmission in the C.N.S.
   b. General anaesthetics
   c. Alcohols and Disulfiram
   d. Sedative and hypnotics
   e. Anti-anxiety agents and centrally acting muscle relaxants
   f. Psychopharmacological agents (Anti-psychotic, antidepressants, antimaniacs and hallucinogens)
   g. Anti-epileptic drugs
   h. Anti-parkinsonian drugs
   i. Analgesics, antipyretics and anti-inflammatory agents
   j. Narcotic analgesics and antagonists.
   k. CNS stimulants

**Unit-II**

4. **Pharmacology of Endocrine system:**
   a. Hypothalamic and pituitary hormones
   b. Thyroid hormones and antithyroid drugs,
   c. parathormone calcitonin and vitamin D.
   d. Insulin, oral hypoglycemic agents and glucagon.
   e. ACTH and corticosteroids.
   f. Androgens and anabolic steroids.
   g. Drugs acting on the uterus.

5. **Autocoids:**
   a. Histamine, 5-HT and their antagonists
   b. Prostaglandins, thromboxane and Leukotrienes
c. Pentagastrin, cholecystokins, angiotensin, bradykinin and substance P.

**Unit-IV**

6. **Important disorders of organ system and their management:**
   a. CNS disorders: epilepsy, Parkinson’s disease, Alzheimer’s disease, depression, schizophrenia, migraine.
   b. Endocrine disorders: Diabetes Mellitus and thyroid disorders.
   c. Joint and connective tissue disorders: rheumatic disease, gout and hyperurricemia.

**PRACTICALS**

(6 hrs / week)

1. Introduction to experimental pharmacology
2. Preparation of different solutions for experiment
4. Common laboratory animals and anesthetics used in animal studies.
5. Demonstration of Standard techniques in pharmacology
6. Blood sampling Drug administration procedures,
7. Procedures for rendering animals unconscious, chemical euthanasia.
8. Simulation of Graded bioassay on rat ileum
9. Simulation of recording of mydriasis and miosis on rabbit eye
10. Simulation of recording of gastric motility on frog oesophagus
11. Simulation of recording of heart rate and force of contraction
12. Simulation of recording of blood pressure of dog
13. Audio visual teaching of drug evaluation on different animals:
   13.1. Rabbit
   13.2. Mice
   13.3. Rats

Demonstration of effect of various drugs on following pathologies using suitable animal models:

14. Inflammation
15. Epilepsy
16. Analgesia
17. Stereotypy
18. Anxiety
19. Depression
20. Stress

**List of Books Recommended**

**Text Books**


**Reference Books**


**THEORY**

Lectures: 4 hrs / week

**Unit - I**

1. General technique of biosynthetic studies and basic metabolic pathways like shikimic acid pathway, acetate malonate pathway and acetate mevalonate (isoprenoid) pathway. An introduction to biogenesis of secondary metabolites of pharmaceutical importance.
2. Study of chemical and spectral approaches to simple molecules belongs to class alkaloids, glycosides, terpenoids and flavonoids.
3. Glycosides- medicinal importance and structure elucidation of glycosides like sinigrin and amygdalin.

**Unit - II**

4. Terpenoids- structure elucidation and medicinal importance of phytoconstituent like phytol, abietic acid, zingiberene, carvone, farnesol and caryophyllene, geraniol.
5. Irridoid- Importance, isolation and biosynthesis of medicinal important irridoid like aucubin, catalpol.

**Unit - III**

7. Steroids: structure elucidation and medicinal importance of the steroidal compounds like squalene, vitamin D and cholesterol.

**Unit - IV**

Revised syllabus w.e.f. 2014-15 session
8. Alkaloids: Structure elucidation of medicinal important alkaloids from the following class:
   - Phenylethylamine - Ephedrine
   - Pyridine - Piperine
   - Pyrolidine - Atropine and related alkaloids
   - Quinoline - Quinine
   - Isoquinoline - Papaverine
   - Phenanthrene - Morphine
   - Indole - Ergot
   - Purine - caffeine

9. Flavonoids: structure elucidation and medicinal importance of flavonoids like pelarogonidin, cyanidin and quercetin.

**PRACTICALS**

1. Different methods of extraction, isolation and identification of phytoconstituents pharmaceutical importance.
2. To check the authenticity of crude drugs by UV radiation.
3. To determine the volatile oil content and extractive value of the crude drugs.
4. To perform the TLC profile of different phytoconstituents.
5. To estimate the carvone content in caraway oil.
6. To estimate the glycyrrhizic acid in liquorice root.
7. To determine the aldehyde content in lemon oil.
8. To isolate the volatile oil from the clove buds.
9. To determine the eugenol content of the volatile oil.
10. To isolate the casein from the milk and report % yield.
11. To isolate the ricinoleic acid from the castor oil.
12. To isolate the caffeine and to identify it.
13. To isolate the nicotine from tobacco leaves and to identify it.
14. To isolate the piperine from the black pepper and to identify it.
15. To isolate the hesperidin from the orange peel and to identify it.

**List of Books Recommended**

*Text Books*
8. Paul m Dewick, "Medicinal Natural Products", John Wiley & Sons, NY

*Reference Books*
9. Manitto, P., "The Biosynthesis of Natural products", Ellis Horwood, Chichester

**THEORY**

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<thead>
<tr>
<th>BPH – 6.4</th>
<th>PHARMACEUTICS IX (Forensic Pharmacy)</th>
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<td>Lectures = 6 hrs / week</td>
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**Unit - I**

1. A brief review of evolution of Pharmaceutical legislation in India.
3. Drugs and Cosmetics Act, 1940 and rules there under.

**Unit - II**


**Unit - III**


**Unit - IV**

11. Pharmaceutical Ethics

**Note:** The teaching of all the above acts should cover the latest amendments.

Revised syllabus w.e.f. 2014-15 session 28
B.PHARM. 7TH SEMESTER

BPH – 7.1 PHARMACEUTICS X (Pharmaceutical Technology)

THEORY Lectures: 6 hrs / week

Unit - I

1. **Tablets**: Types of tablets, formulation of tablets, various granulation techniques including slugging, chilsonator, extructor, Day-Nauta granulator, double cone granulator, spray granulator. Tableting machinery for production of single layer, multilayer and compression coated tablets. Tablet coating: sugar coating, film coating and compression coating, coating processes i.e. air suspension coating and pan coating (using conventional, rear vented and perforated pans). Quality Control of Tablets.

Unit - II

2. **Capsules**: Types, material, machinery, manufacture, sizes and other pharmacopoeial requirements of capsule shells. Formulation, large-scale production and quality control of Hard and Soft capsules. Applications, advantages and disadvantages of capsule dosage form.

3. **Microencapsulation**: Terminology, advantages and applications. Study of various processes employed for microencapsulation i.e. coacervation phase separation, multiorifice, centrifuge, electrostatic deposition, vacuum deposition, spray drying, spray congealing, polymerization, complex emulsion, air suspension technique and pan coating.

4. **Aerosols**: Definitions, advantages and applications, liquified-gas system, compressed gas system, propellants, containers, valves, cold-filling process, pressure filling process and quality control of aerosols.

Unit - III

5. **Parenterals**: Types of parenteral products and formulation considerations. Types and Quality of Water used in Parenterals and requirement of Clean room. Production facilities, methods of production, containers and packaging of Small Volume and Large Volume Parenterals and their quality control. Large scale production of Injectable Grade Water. Quality control of parenterals.

6. **Controlled and Novel Drug Delivery**: Classification, design, development, production and evaluation of Oral and Controlled Drug Delivery Systems.

Unit - IV


8. **Scale up Techniques**: Basic Concepts, Scale up of Tablets.

9. **Radiopharmaceuticals**: Fundamentals of Radio-pharmacy, therapeutic applications of isotopes, diagnostic applications of isotopes, use of radioisotopes in basic research, product development, product production, process control and quality control.

PRACTICALS

Number of experiments based on aforementioned theory

Books Recommended

2. Leon Lachman, H A Liberman and J L Kanig, "The Theory and Practice of Industrial Pharmacy, Lea & Feibiger, Philadelphia
3. "Bentley's Textbook of Pharmaceutics", ELBS Bacilliere Tindall
5. S Turco and R E king, "Sterile Dosage Forms", Lea & Febiger, Philadelphia
7. Encyclopedia of Pharmaceutical Technology by Swarbrick
9. Pharmacopoeia of India.

BPH – 7.2 PHARMACEUTICAL CHEMISTRY VIII (Analytical Chemistry II)

THEORY Lectures: 6 hrs / week

Unit - I

Quality Assurance: Philosophy of GLP, ISO-9000. TQM, Quality Review and Quality documentation. Regulatory aspects: Legislation & regulatory control, regulatory drug analysis, interpretation of analytical data. Validation/Quality audit; Quality of equipment; Validation of equipment; Validation of analytical procedures.

Turbidimetry and Nephelometry: Theory of light scattering, Nephelometry, Turbidimetry for Practical Analysis of dispersions, study of the working principles of instrument used for analysis and applications in Pharmacy.
Unit - II
The theoretical aspects, basic instrumentation, elements of interpretation of spectra and applications of the following analytical techniques should be thoroughly studied
a) Ultraviolet and Visible Spectrophotometry.

b) Fluorimetry.

c) Infrared spectrophotometry.

Unit - III
The theoretical aspects, basic instrumentation, elements of interpretation of spectra and applications of the following analytical techniques should be thoroughly studied
a) Flame photometry.

b) Atomic absorption spectroscopy

c) Nuclear magnetic resonance spectroscopy including $^{13}$C NMR.

d) Mass spectroscopy.

Unit - IV
Fundamentals of Chromatography. Introduction and theory of underlying different types of chromatography techniques like Column chromatography, thin layer chromatography, paper and circular chromatography, adsorbents and solvents used in these techniques. Gas chromatography: introduction, principles of gas chromatography, basic GLC apparatus, sample introduction, column, column efficiency, solid support, liquid phases, branches of gas chromatography, detectors, temperature effect, application of GLC in pharmaceutical analysis. HPLC: introduction and nomenclature, instrumentation, liquid solid chromatography, liquid liquid chromatography, exclusion chromatography. HPLC columns, solvent selection in HPLC, data handling in HPLC, applications of HPLC, HPTLC - instrumentation and applications..

PRACTICALS (6 hrs / week )
1. Exercises involving UV-visible spectroscopy, fluorimetry, flame photometry, Nephelo-turbidimeter.
2. IR of samples with different functional groups
3. Workshop to interpret the structure of simple organic compounds using UV, IR, NMR and MS.
4. Experiments based on chromatographic techniques

List of Books Recommended
Text Books

Reference Books
5. Skoog, “Fundamental of Analytical Chemistry”.

BPH – 7.3 PHARMACOGNOSY IV

THEORY
Lectures: 5 hrs / week

Unit - I
1. Role of medicinal and aromatic plants trade in national economy of a country and introduction of world-wide trade regulations of herbal products.
2. Current trade status and potential of some commercially important plants like diosgenin (dioscorea), taxol (taxus sps), digitalis, vinca, papain, cinchona, ginseng and laxative plants.

Unit - II
3. Govt and private institutions and industries working in the study, research and analysis of medicinal and aromatic plants in India.
4. Traditional and recent methods of extraction of bioactive compounds alongwith their merits and demerits.

Unit - III

Unit - IV
7. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance. Application of plant tissue culture in pharmacognosy.
8. Natural allergens and photosensitizing agents.

PRACTICALS (6 hrs per week )

Number of experiments based on aforementioned theory and including the following:
1. Isolation and analysis of some selected phytoconstituents studied in theory.
2. Extraction of volatile oils and their chromatographic profiles.
3. Some experiments on basic techniques of plant tissue culture.
List of Recommended Books

6. “Supplement to Cultivation and Utilization of Medicinal Plants”, RRL, Jammu.

**BPH – 7.4 PHARMACOLOGY IV**

**THEORY**  
Lectures: 5 hrs / week

**Unit-I**

1. **Introduction to Biotechnology:**
   a. Definition, history, different branches and scope of biotechnology.
   b. Therapeutical and pharmaceutical applications of biotechnology.

2. **Enzymes:**
   a. Production of enzymes
   b. Methods of immobilization of enzymes: Adsorption, entrapment, microencapsulation and covalent coupling
   c. Analytical applications of immobilized enzymes
   d. Enzymes used in DNA recombinant technology
   e. Study of enzymes such as hyaluronidase, streptokinase, streptodornase, amylases and protease etc.

**Unit-II**

3. **Immunology and Immunological preparations:**
   Cellular and humoral immunity, immunological tolerance, antigen-antibody reactions and their applications.

4. **Genetic engineering:**
   a. Concept and techniques of genetic engineering (gene transfer via transduction, transformation, conjugation, protoplast fusion and gene cloning).
   b. DNA replication, its repair and recombination.
   c. Applications of genetic engineering for production of pharmaceuticals

**Unit III**

5. **Tissue Culture and Cell Culture Technology:**
   a. Introduction to cell culture and culture media
   b. Culture procedures and primary cultures
   c. Evolution of mammalian cell lines
   d. Cloning of cell lines
   e. Animal tissue culture and organ culture
   f. Embryo culture and egg culture
   g. Culturing of human embryonic stem cells
   h. In vitro fertilization in humans

6. **Biotechnology in the field of pharmacy:**
   a. Study and production of drugs obtained from biotechnology: Erythropoietins, interferons, vaccines, anticoagulants / thrombolytic agents, monoclonal antibodies, hormones etc.
   b. Design of drug delivery system for biotechnological products

**Unit IV**

7. **Oncogenes and Tumor Suppressor Genes:**
   a. Viral and cellular oncogenes.
   b. Tumor suppressor genes from humans.

**List of Books Recommended**

**Text Books**

**Reference Books**
B.PHARM. 8TH SEMESTER

BPH – 8.1 PHARMACEUTICAL CHEMISTRY IX
(Medical Chemistry II)

THEORY

Lectures: 6 hrs / week

Unit I
Drug metabolism. Functionlization reactions (Phase I) - Oxidation, reduction and hydrolytic reactions. Conjugation reactions: Glucuronic acid conjugation, sulphate conjugation, conjugation with amino acids, glutathione conjugation, acetylation, methylation. Chemistry and principles of prodrug design. QSAR by Hansch analysis

Unit II
Mode of action, uses, structure activity relationship including physico-chemical properties of the following classes of drugs: Drugs acting on Central nervous System: General anesthetics, Local anesthetics, Hypnotics and sedatives, opioid analgesics, antiulcerants, anticonvulsants, antiparkinsonian drugs, CNS stimulants, psychopharmacological agents (neuroleptics, antidepressants, anxiolytics). Steroids and related drugs: Steroidal nomenclature and stereochemistry; androgens and anabolic agents; oestrogens and paragametasterone and adrenal corticoids.

Unit III

Unit IV

PRACTICALS
( 6 hrs / week )

1. Number of experiments based on QSAR
2. Synthesis of Methyl orange; Adduct of anthracene and maleic anhydride; P-nitroaniline; Sulphanilic acid; Sorbic acid; Mannich reaction; Methyl salicylate; Bentriazole; Benzamide; Bakelite

List of Books Recommended
Text Books
Reference Books

BPH – 8.2 PHARMACOLOGY V

THEORY

Lectures: 6 hrs / week

Unit I
1. Drugs acting on the Gastrointestinal Tract:
   a. Antacids, antisecretory and anti-ulcer drugs.
   b. Laxative and antidiarrhoeal drugs.
   c. Appetite stimulants and suppressants.
   d. Emetics and anti-emetics.
   e. Miscellaneous: carminatives, demulcents, protectives, adsorbenet, astringents, digestants, enzymes and mucolytics.
2. Pharmacology of Cardiovascular System
   a. Digitalis and cardiac glycosides
b. Anti-hypertensive drugs
c. Anti-anginal and vasodilator drugs
d. Anti-arrhythmic drugs.
e. Anti-hyperlipidemic drugs
f. Drugs used in therapy of shock

3. **Drugs acting on the urinary system**
   a. Fluid and electrolytic balance
   b. Diuretics

4. **Drugs acting on the Haematopoietic system**
   a. Haematinics
   b. Anticoagulants, vitamin K and haemostatic agents
   c. Fibrinolytic and Anti-platelet drugs
d. Blood and plasma volume expanders

5. **Drugs acting on the respiratory system**
   a. Anti-asthmatic drugs including bronchodilators
   b. Anti-tussive and Expectorants
c. Respiratory stimulants

6. **Chemotherapy:**
   a. General principles of chemotherapy.
   b. Sulphonamides and co-trimoxazole.
c. Antibiotics, penicillins, cephalosporins, beta-lactamases, tetracyclines, aminoglycosides, chloramphenical, erythromycin, quinolones and miscellaneous antibiotics.
d. Chemotherapy of tuberculosis, laprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.
e. Chemotherapy of malignancy and Immunosuppressive agents.

Unit II

7. **Principles of Toxicology:**
   a. Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates opioids, organophosphorous and atropine poisoning.
b. Heavy metals and heavy metal antagonists

8. Introduction to Clinical Pharmacy.
10. Concept of essential drugs and rationale drug use.

11. **Basic concepts of Pharmacotherapy:**
   a. Clinical Pharmacokinetics and individualisation of drug therapy.
b. Drug delivery systems and their biopharmaceutic and therapeutic considerations.
c. Drug use during infancy and in the elderly (Paediatrics & Geriatrics).
d. Drug use during pregnancy.
e. Drug induced disease.
f. The basics of drug interactions.
g. General principles of clinical toxicology.
h. Interpretation of clinical laboratory tests.

Unit III

12. **Important disorders of organ system and their management:**
   a. Cardiovascular disorders: hypertension, congestive heart failure, angina, acute myocardial infarction and cardiac arrhythmias.
b. Respiratory disease: asthma.
c. Gastrointestinal disorders: peptic ulcer disease, ulcerative colitis, hepatitis and cirrhosis.
d. Haematopoietic disorders: anemias.
e. Infectious disease: tuberculosis, urinary tract infection, enteric infections, upper respiratory infections.

**PRACTICALS**

(6 hrs / week )

Demonstration of effect of various drugs on following pathologies using suitable animal models:
1. Stress
2. Alzheimer’s disease
3. Parkinson’s disease
4. Diabetes
5. Diarrhoea
6. Hypertension

Demonstration of techniques and equipments utilized in pharmacological Research

7. Microtome
8. Langendorff’s apparatus
9. Autoanalyzer
10. Electrophoresis
11. Neurotransmitter estimation

Revised syllabus w.e.f. 2014-15 session
12. Estimation of Oxidative stress

Demonstration of Bioassay procedures
13. matching bioassay
14. bracketting bioassay
15. interpolation bioassay
16. 4 point bioassay
17. pA2 determination
18. pD2 determination
19. Delineation of mechanism of action by drug antagonism
20. Delineation of mechanism of action by drug agonism

Simulations on pharmacological experimentation

Alternatives to Animal Experimentation
To demonstrate the procedures for recording the effects of self chosen placebos or samples on human behaviors:
21. anxiety
22. sedation
23. Analgesia
24. Skin irritation
25. inflammation

List of Books Recommended

Text Books
2. Davidson’s Principles and Practice of Medicine”, Churchill Livingstone

Reference Books

BPH – 8.3 PHARMACEUTICS XII (Biopharmaceutics)

THEORY Lectures: 6 hrs / week

Unit - I
1. Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting.
2. Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis).
3. Factors influencing absorption-physiochemical, physiological and pharmaceutical.
4. Drug distribution in the body, barriers to distribution of drugs in the body.
5. Models in Biopharmaceutics – Introduction to compartment models, non-compartmental models, physiological models and pharmacological models.

Unit - II
6. One compartmental kinetics – determination of various pharmacokinetic parameters, such as K, t1/2, Vd, etc., after drug administration by intravascular route and oral route, from plasma and urine data. Significance of plasma drug concentration measurements and various pharmacokinetic parameters as above. Application of method of residuals in compartmental kinetics.
7. Two compartmental kinetics – determination of various pharmacokinetic parameters, such as K, t1/2, Vd, etc., after drug administration by intravascular route and oral route, from plasma and urine data. Significance of plasma drug concentration measurements and various pharmacokinetic parameters as above. Application of method of residuals in compartmental kinetics. Application of Wagner nelson method and Loo-Riegelmann method.
8. Pharmacokinetics of drug administration by slow intravenous infusion route.

Unit - III
11. Metabolism of drugs : Hepatic metabolism of drugs, first pass effect, extraction ratio, biliary excretion of drugs, enterohepatic circulation.
13. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michales Menten equation, determination of non-linearity (saturation mechanism).

Unit - IV
14. Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michales Menten equation, determination of non-linearity (saturation mechanism).
15. Adjustment of dosage regimen in patients of renal failure.
16. Introduction to pharmacokinetic drug interactions and their significance in combination therapy.
17. Bioavailability and bioequivalence. Measures of bioavailability – Cmax, tmax and Area under the curve, AUC. Design of single dose bioequivalence study. Overview of regulatory requirements for bioavailability and bioequivalency.

PRACTICALS

Number of experiments based on aforementioned theory topics, should be conducted.

List of Books Recommended

Text Books
1. L Shargel and B C Andrew, "Applied Biopharmaceutics and Pharmacokinetics", Prentice Hall International, USA.
2. Brahmankar, CBS Publishers

Reference Books
6. M Gibaldi and D Parrier, "Pharmacokinetics", Marcel Dekker Inc, NY

BPH – 8.4 PHARMACEUTICS XIII (Pharmaceutical Packaging)

THEORY Lectures: 4 hrs / week

Unit - I
1. Introduction: Purpose of packaging, selection of the ideal package, hazards encountered by the package, various types of inner and outer packages, selection of a suitable package.
2. Child resistant package and Tamper Evident Packaging.
3. Packaging materials: Detailed study with regard to composition packaging characteristics, advantages, economics and limitations of various packaging materials with special emphasis on glass, plastics, metals and rubber. Evaluation of packaging materials.
4. Environmental considerations of packaging

Unit - II
5. Production of oriented and non-oriented films and laminates.
6. Strip Packing: Significance of Strip Packing, advantages, economics and limitation of Strip Packing, Strip Packing machinery, films employed in Strip Packing (including composites and laminates) and evaluation of films and strips packs.
7. Blister Packaging: Blister packing materials, significance of Blister packing, advantages, economics and limitation of blister packing, blister packing machinery, various types of blister packages, evaluation of blister package.
8. Pouch packaging: Materials used, advantages, economics and limitation of pouch packing, pouch packing machinery, spectrum of applications, evaluation of pouch packing.

Unit - III
7. Semi-Solid Packaging: Various types of containers/packages used for semi-solid products, filling and sealing machinery (including collapsible tube filling and sealing machine) merits and limitations of various packages, evaluation of semi-solid product package.
8. Labelling: Types of label (including Bar code, RF, structured program, in-mould and decorative labeling). Legal requirements of Labelling, packaging inserts and outserts. Adhesives and machinery employed for labelling. Concept of paperless labeling.
Unit - IV

9. Sterile Product Packaging: General principles of packaging of sterile products. Various types of containers used for sterile products including small volume and large volume parenterals. Types of closures used for the sterile products. Sterile product filling and sealing machinery i.e. ampoule filling and sealing machine. Limitations and merits of various packages. Evaluation of the sterile product packages

Books Recommended
3. Deans .