ADMISSION
&
EXAMINATION RULES
&
SYLLABUS

FOR

BACHELOR IN PHARMACY

FACULTY OF PHARMACY
JAMIA HAMDARD
(Deemed University)
Hamdard Nagar, New Delhi - 110062
ADMISSION & EXAMINATION RULES
FOR
BACHELOR IN PHARMACY
1. Program: Bachelor in Pharmacy (B. Pharm)

It shall be a fulltime regular course.

Duration an academic year, a candidate shall be enrolled only for one program of study and shall not appear in any other examination of this or any other University.

2. Duration: Four years

3. Medium of Instruction and Examination: English

4. Eligibility for admission: A candidate seeking admission to this course must have:

   a) Passed 10+2 examination from Central Board of Secondary Education, or any other examination recognized by Jamia Hamdard as equivalent thereto, with at least 50% marks in the aggregate of Physics, Chemistry and Biology subjects, and must have passed in each of these subjects.

   b) Qualified the admission test/interview conducted by Jamia Hamdard.

   c) Completed the age of 17 years on or before the first day of October of the year of admission.

Some seats are provided for those candidates who opt for an additional course in Unani Pharmacy. All such candidates will have to appear in all the subjects of Modern Pharmacy in addition to the additional papers in Unani Pharmacy (Urdu medium). On the successful completion of the course, these candidates will be entitled to award of degree in Modern Pharmacy and a separate certificate for Unani course. Proficiency in Urdu, comparable to Matric standard is essential for such candidates.

5. Course structure:

The numbers of hours of teaching in theory as well as practical in the various subjects of this course are listed below. The course contents are given in the syllabus.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Subject</th>
<th>Course Code</th>
<th>Min. Teaching hrs.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Theory</td>
<td>Practical</td>
</tr>
<tr>
<td>1.</td>
<td>Pharmaceutics-I</td>
<td>BPH 01</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>(Introduction to Pharmacy)</td>
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<tr>
<td>2.</td>
<td>Pharmaceutics-II (Unit Operation)</td>
<td>BPH 02</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>3.</td>
<td>Pharmaceutics-III</td>
<td>BPH 03</td>
<td>50</td>
<td>100</td>
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<tr>
<td></td>
<td>(Dispensing Pharmacy)</td>
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<tr>
<td>4.</td>
<td>Pharmaceutical Chemistry-I</td>
<td>BPH 04</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>(Organic Chemistry)</td>
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<tr>
<td>5.</td>
<td>Pharmaceutical – II</td>
<td>BPH 05</td>
<td>50</td>
<td>100</td>
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<tr>
<td></td>
<td>(Inorganic Medicinal &amp; Pharmaceutical Chemistry)</td>
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<tr>
<td>6.</td>
<td>Pharmacognosy – I</td>
<td>BPH 06</td>
<td>50</td>
<td>75</td>
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<tr>
<td></td>
<td>(Pharmaceutical Biology)</td>
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<tr>
<td>7.</td>
<td>Human Anatomy and Physiology</td>
<td>BPH 07</td>
<td>75</td>
<td>75</td>
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<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>375</td>
<td>650</td>
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<tr>
<td></td>
<td>Unani Pharmacy</td>
<td>BU 01</td>
<td>15</td>
<td>-</td>
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<tr>
<th>IInd year</th>
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<td>8.</td>
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<td>9.</td>
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<td>10.</td>
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<td>11.</td>
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<td>12.</td>
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<td>13.</td>
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<td>14.</td>
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<td>15.</td>
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<td></td>
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<tr>
<td>IIIrd year</td>
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<tr>
<td>-----------</td>
</tr>
<tr>
<td>17. Pharmaceutics-VI (Hospital &amp; Clinical Pharmacy)</td>
</tr>
<tr>
<td>18. Pharmaceutics – VII (Forensic Pharmacy &amp; Ethics)</td>
</tr>
<tr>
<td>19. Pharmaceutics-VIII (Pharmaceutical Formulations &amp; Cosmetology)</td>
</tr>
<tr>
<td>20. Pharmaceutical Chemistry-V (Pharmaceutical Analysis-II) (Physical Chemistry &amp; Principles of Instrumental Analysis)</td>
</tr>
<tr>
<td>21. Pharmaceutical Chemistry-VI (Medicinal Chemistry-I)</td>
</tr>
<tr>
<td>22. Pharmaceutical Chemistry-VII (Chemistry of Natural Products)</td>
</tr>
<tr>
<td>23. Pharmacognosy-III (Pharmacognosy and Phytochemistry)</td>
</tr>
<tr>
<td>24. Pharmacology-II</td>
</tr>
<tr>
<td>25. Biochemistry</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
<tr>
<td>Tour Report-Pharmacognosy</td>
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<table>
<thead>
<tr>
<th>IVth year</th>
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<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>27. Pharmaceutics-IX (Pharmaceutical Management)</td>
<td>BPH 27</td>
<td>50</td>
<td>-</td>
<td>50</td>
</tr>
<tr>
<td>28. Pharmaceutics-X (Biopharmaceutics &amp; Pharmacokinetics)</td>
<td>BPH 28</td>
<td>50</td>
<td>100</td>
<td>150</td>
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<tr>
<td>29. Pharmaceutics-XI (Pharmaceutical Technology)</td>
<td>BPH 29</td>
<td>50</td>
<td>100</td>
<td>150</td>
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<tr>
<td>30. Pharmaceutical Chemistry-VIII (Pharmaceutical Analysis-III)</td>
<td>BPH 30</td>
<td>50</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>31. Pharmaceutical Chemistry-IX (Medicinal Chemistry-II)</td>
<td>BPH 31</td>
<td>50</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>32. Pharmacognosy-IV (Industrial Pharmacognosy)</td>
<td>BPH 32</td>
<td>50</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>33. Pharmacology-III</td>
<td>BPH 33</td>
<td>50</td>
<td>100</td>
<td>150</td>
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<td><strong>Total</strong></td>
<td></td>
<td><strong>375</strong></td>
<td><strong>600</strong></td>
<td><strong>975</strong></td>
</tr>
<tr>
<td>Tour report-Pharmaceutics</td>
<td>BU 04</td>
<td>12</td>
<td>8</td>
<td>20</td>
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6. **Scheme of Examination:**

The distribution of marks for sessional in theory and practical work in different papers during the four years of study is detailed below. The duration of annual examination in theory as well as practical papers will be 3 hours. Unless specified otherwise.
<table>
<thead>
<tr>
<th>S.No</th>
<th>Year/Paper</th>
<th>Marks Theory</th>
<th></th>
<th>Marks Practical</th>
<th></th>
<th>Grand Total</th>
</tr>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Annual</td>
<td>Sessional</td>
<td>Annual</td>
<td>Sessional</td>
<td>Total</td>
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<tr>
<td>1st year</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Pharmaceutics-I (Introduction to Pharmacy)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>Pharmaceutics-II (Unit Operation)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>Pharmaceutics-III (Dispensing Pharmacy)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>4.</td>
<td>Pharmaceutical chemistry-I (Organic Chemistry)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>#80</td>
<td>20</td>
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<tr>
<td>5.</td>
<td>Pharmaceutical Chemistry-I (Inorganic Medicinal &amp; Pharmaceutical Chemistry)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>#80</td>
<td>20</td>
</tr>
<tr>
<td>6.</td>
<td>Pharmacognosy-I (Pharmaceutical Biology)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>7.</td>
<td>Human Anatomy &amp; Physiology</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>700</strong></td>
<td></td>
<td><strong>700</strong></td>
<td></td>
<td><strong>1400</strong></td>
</tr>
<tr>
<td></td>
<td>Unani Pharmacy</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>-</td>
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<tr>
<td>*# Duration of practical examination -4 hrs; For others -3 hrs.</td>
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<td></td>
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</tr>
<tr>
<td>2nd year</td>
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</tr>
<tr>
<td>8.</td>
<td>Pharmaceutical Maths &amp; Biostatistics</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>9.</td>
<td>Pharmaceutics-IV (Pharmaceutical Microbiology)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>*80</td>
<td>20</td>
</tr>
<tr>
<td>10.</td>
<td>Pharmaceutics-V (Physical Pharmacy)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>*80</td>
<td>20</td>
</tr>
<tr>
<td>11.</td>
<td>Pharmaceutical Chemistry-III (Inorganic Chemistry)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>#80</td>
<td>20</td>
</tr>
<tr>
<td>12.</td>
<td>Pharmaceutical Chemistry-IV (Organic &amp; Medicinal Chemistry)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>#80</td>
<td>20</td>
</tr>
<tr>
<td>13.</td>
<td>Pharmacognosy-II (General Pharmacognosy)</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>14.</td>
<td>Pathophysiology, Toxicology &amp; Health Education</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>15.</td>
<td>Pharmacology-I</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>*80</td>
<td>20</td>
</tr>
<tr>
<td>16.</td>
<td>Computer Applications</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>900</strong></td>
<td></td>
<td><strong>700</strong></td>
<td></td>
<td><strong>1600</strong></td>
</tr>
<tr>
<td></td>
<td>Unani Pharmacy</td>
<td>80</td>
<td>20</td>
<td>100</td>
<td>80</td>
<td>20</td>
</tr>
<tr>
<td>*# Duration of practical exam. - 6 hrs; # Duration of practical exam. – 4 hrs; For others - 3 hrs.</td>
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</tbody>
</table>
7. Internal Assessment:
   a) For the purpose of awarding sessional marks, the performance of students shall be evaluated continuously on the basis of written tests/seminars/viva voce, etc. in each course. The respective teachers will give these.
b) Each theory test will be of two hours duration. These will be conducted as per a schedule notified by the Dean, Faculty of pharmacy. The respective teachers will hold practical sessional tests in regular classes. Three tests (theory and practical) will be properly spaced in the three terms of the academic session.

c) The marks obtained shall be notified in time by the respective teachers and answer books shown to the students, if they wish so. The sessional test answer books shall be retained in the Department till the end of the academic term.

d) There shall be at least three tests for each course and the average of best two tests shall be taken to award the sessional marks. There will be no provision for special or additional internal assessment tests.

e) A regular record of the marks for sessional tests conducted in an academic year shall be maintained by the teacher concerned/Head of Department for each student.

f) The students shall maintained tour reports for assessment by the teachers conducting the tour.

g) The final sessional marks shall be submitted by the teachers to the Head of the Department who shall forward the same to the registrar, within ten days of the last sessional test held. These shall also be displayed on the Notice Board of the Department/Faculty.

8. Attendance:

a) All students must attend every lecture and practical class. However, to account for late joining or other such contingencies, the attendance requirement for appearing in the examinations shall be a minimum of 75% of the classes actually held.

b) In order to maintain the attendance record of a particular course a roll call will be taken by the teacher in every scheduled lecture and practical class. For the purpose of attendance, every scheduled practical class will be counted as one attendance unit, irrespective of the number or contact hours.

c) The teacher in charge will consolidate the attendance record for the lectures and practicals for each term. Attendance on account of participation in the prescribed function of NCC, NSS, Inter university sports, educational tours/field work shall be credited to aggregate, provided the attendance record, duly countersigned by the Officer in-charge, is sent to the Dean of Faculty within two weeks of the function/activity, etc.
d) The statements of attendance of students shall be displayed on Department Notice Board at the close of each term as given in the University Calendar. A copy of the same shall be sent to the Head of Department/Office of Dean of Faculty for record. Notice displayed on Notice Board shall be deemed to be proper notification, and no individual notice shall be sent to students.

e) If a student is found to be continuously absent from the classes without information for a period of 30 days, the teacher in charge shall report it to the Head of Department/Dean for striking off the name of such a student from rolls. Such a student may, however, apply for readmission within 15 days from the date of issue of the Notice of striking off the name. The request may be considered by the Dean for readmission. Such a student shall not be readmitted after the prescribed period. The readmission shall be effected on payment of prescribed readmission fees.

f) A student with less than 75% attendance of the lectures and practicals separately in each subject/course in an academic year shall be detained from appearing in the Annual University examination. The Dean of Faculty concerned may consider application for the condonation of attendance upto 5% on account of sickness, provided the application for condonation of attendance, duly certified by a Registered Medical Practitioner/Public Hospital had been submitted within 5 days from the recovery from illness. Condonation of attendance on account of any other extenuating circumstances may also be considered, provided the request is duly supported by documentary evidence.

g) A student detained on account of attendance will be readmitted to the same class in the next academic year on payments of current fees except Enrollment fee, Identity card fee and Security deposits.

9. Eligibility for admission to examination:
A student seeking admission to the examination to be held at the end of each academic year must have pursued a regular course of study for one academic year, and must have completed the prescribed attendance requirements. Further, a student admitted to any course must pass the first year examination within two academic years, and must complete the full course of study within prescribed span period of seven years.

10. Annual and Supplementary examinations:
a) The annual and Supplementary examinations shall be held as per schedule given in the Academic Calendar of Jamia Hamdard. The Supplementary examinations may normally be held after 30 days from the declaration of results of the Annual examination.
b) A candidate who fails to appear in the annual examination or having appeared in the Annual examination fails to pass in any subject(s) as prescribed for the examination, may be allowed to appear in the remaining subjects in the Supplementary examination.

c) A candidate will be given a total number of three attempts, inclusive of the first attempt, to clear the papers in which he/she fails to qualify (irrespective of the number of such papers). In exceptionally hard cases, a student may be considered for grant of one last mercy chance.

d) The Dean of the Faculty will examine application for mercy chance with proper justification and a written undertaking given by the student, and specific recommendations will be forwarded to the Registrar for getting approval of the competent authority. The undertaking would be to the effect that in case he/she does not clear the backlog in this final attempt, he/she will not have any further claim to continue the studies and that his/her name may be struck off the rolls.

e) The duration of annual examination in theory as well as practical papers will be 3 hours, unless specified otherwise.

f) Examiners shall examine students orally during the Practical examination and take cognizance of their performance when marking their papers.

g) A student shall not be declared to have passed the examination unless he/she secures at least 50% marks in each of the subjects separately in the theory as well as practical examinations, including sessional marks. Each theory paper or practical examination shall be construed as a separate paper.

h) Ten days vacation shall be given as preparatory holidays before the commencement of Annual Examinations.

i) The candidates will retain the Internal Assessment of the previous examination, wherever applicable.

11. Promotion to next class:
   a) All students securing at least 50% marks in each of the subjects separately in the theory as well as practical examinations, including sessional marks, shall be promoted to the next year of study.
b) A student who fails in one or two subjects (separately in theory and practicals), and secures at least 50% marks in the aggregate, may be provisionally promoted to the next higher class. However, such a student shall have to clear these subjects in the year to which thus promoted provisionally.

c) A student who fails in more than two subjects will have to repeat the year of study and clear it within the prescribed span period.

d) A student who has been promoted as per clause (b) above and fails to clear the backlog in the year to which promoted provisionally, will be required to rejoin the year to which the carried over papers belonged, as a regular student. He/she will be registered only in those subjects in which he/she could not secure the minimum pass marks of the last examination. For instance, if a student was provisionally promoted to II year with a carry over of two papers of I year, and he/she does not succeed in clearing the carry over papers of I year along with the regular papers of II year, he/she will have to join I year again and register only in the backlog papers.

e) Promotion to the next higher class will be considered subject to rules relating to the maximum period of stay at the University, viz. passing the first year examination within two academic year, and successfully completing all the requirements of the programme of study within seven years from admission.

12. Classification of successful candidates:

a) The result of the successful candidate shall be classified at the end of the final year examination on the basis of the aggregate of all subjects, theory and practicals, secured by the candidate in the II to IV year examinations, as indicated below.

- **1st Division:** 60% and above
- **2nd Division:** 50% - 59%

b) Candidate securing 75% or above marks in any subject(s) and have passed in all the subjects in a year in first attempt shall be declared to have obtained Distinction in that subject(s).

c) A student shall be eligible for award of Gold Medal subject to the following criteria.

- He/she has secured the highest marks in aggregate of examinations of all the years of the programme of study.

- He/she has obtained a minimum of 60 per cent marks in the aggregate, as stated in (i) above.

- He/she has passed all examination, including qualifying courses, if any, in first attempt.
13. Span Period:

Students must pass the first year examination within two academic years, and must complete the full course of study within seven years from their admission to the first year of the course. However, exceptions to the 7 years rule may be made in the following cases:

A candidate who fails in only one subject in B. Pharm. IVth year Annual examination but has completed the maximum span period of 7 years, may be allowed to avail one more chance in the subject concerned, as a special case.

A candidate who qualifies in at least one subject but fails in half the number of subjects of B. Pharm. IVth year examination, but has completed the span period of 7 years, may be allowed readmission in B. Pharm. IVth year in the concerned subjects as a hard case. Such a student shall have to appear in sessional tests, practicals internal assessments in the concerned subject, and will be required to clear the backlog in the Annual and Supplementary examination.
B-PHARM IST YEAR
1. Pharmacy Profession
Pharmacy as a career, evaluation of pharmacy profession, earlier period, middle to modern ages. Introduction to Pharmacopoeias with special reference to Indian Pharmacopoeia, B.P., U.S.P. and International Pharmacopoeia.

2. Metrology
Imperial, metric and S.I., weights and measures, interconversion

3. Introduction to Dosage forms
Classification of solids, semisolids and liquid dosage forms, conventional and novel delivery systems.

4. Pharmaceutical Additives
Diluents, vehicles, bases, solvents, organoleptic additives, surfactants, polymers and their applications.

5. Size reduction and Size Separation
Definitions, principles of size reduction, objectives of size reduction, factors affecting size reduction; principles, laws and factors affecting energy requirements, different methods of size reduction, study of hammer mill, fluid energy mill and disintegrator. Various methods and equipments employed for size separation e.g., sieving, sedimentation, centrifugal elutriation, microscopic methods.

6. Mixing and Homogenization
Theory of mixing: solid-solid, solid-liquid, liquid-liquid and semisolid mixing. Study of different types of mixers used in pharmaceuticals like planetary mixers, sigma mixers, turbo dispensers, double cone mixers, Colloid mill, Triple roller mill.

7. Clarification and Filtration

8. Heat Processes
**Evaporation:** Factors affecting evaporation, study of evaporating stills and evaporating pans, heat transferring evaporators, vapor compression evaporators and evaporation under reduced pressure.
**Distillation:** Importance of distillation in Pharmacy, methods of distillation. Brief introduction to freeze drying, sublimation, desiccation and exsiccation, efflorescence and its importance.

9. Extraction and Galenicals
Extraction processes and study of percolation and maceration and their modifications, their applications in the preparation of tinctures and extracts.

**PRACTICAL**
Total Hours 100

1. Preparation of following classes of products involving the use of calculations in metrology (at least 2 products from each category wherever applicable):
   - Aromatic waters, injections, solutions, spirits, glycerine, syrups, elixirs, lotions, mucilages and liniments, suppositories, tablets, powders and capsules.

2. Study of one monograph from the latest edition of Indian Pharmacopoeia.

3. Demonstration of equipments (working procedure) for
   i) Size Reduction and size separation
   ii) Mixing and homogenization
   iii) Clarification and filtration
   iv) Evaporation
   v) Distillation
   vi) Percolation

**Books Recommended:**
3. S.J Carter: Tutorial Pharmacy
4. Cooper and Gunn’s: Dispensing Pharmacy
5. N.K.Jain and S.N.Sharma: The theory and practice of Professional Pharmacy

Paper BPH 02

PHARMACEUTICS -II
UNIT OPERATIONS (THEORY)
Total Teaching Hours: 50

1. Introduction
Introduction to unit operation and pharmaceutical engineering. Concept and requirement, basic laws, materials and energy balances.

2. Conveying of Solids
Belt conveyors, chain conveyors, screw conveyors and pneumatic conveyors.

3. Pharmaceutical Plant Construction
Selection of materials for pharmaceutical plants, study of factors like physical, chemical, mechanical and economical. Suitability of different materials for different plants i.e. Ferrous metals - Cast iron, steel, stainless steel; Non-ferrous metals - copper and alloys, aluminum and alloys, lead, tin, silver, nickel and alloys, chromium, zinc; Non-metals glass, stoneware, slate brick, concrete, asbestos, plastics, rubber, timber, ceramics and enamel.

Corrosion: Types, causes, theories and methods of prevention of corrosion.

4. Environmental Pollution and safety hazards
Mechanical, chemical, electrical fire and dust hazards, safety requirements; fire extinguishers; accident records. Environment control and effluent treatment.

5. Flow of fluids

6. Heat transfer
Modes of heat transfer; heat transfer coefficient; OHTC. Convection- concept of film overall coefficient, evaluation of individual film coefficient. Radiation - Stefan Boltzmann law; heating media, equipments, lagging. Fuels - solid, liquid, gases. Steam as heating medium - properties and uses of steam, steam traps, pressure reducing valve, steam heated heat exchanger, lagging, condensation, heating by electricity.

7. Distillation
Theory of distillation, vapor liquid equilibrium relationship, volatility and relative volatility, Azeotropic and zeotropic mixture, phase diagrams. Rectification and construction of columns; molecular distillation; steam distillation; enthalpy composition diagram and determination of number of theoretical plates; HETP.

8. Refrigeration and Air Conditioning
9. Drying
Theory of drying - principles, equilibrium moisture content, rate of drying; drying of dilute solutions and suspensions - drum dryer, spray dryer; drying of solids - convection type, tray dryer, tunnel dryer, rotary dryer, fluidized bed dryer, vacuum dryer, oven dryer, freeze dryer, radiant heat dryers. Automation in drying process.

10. Autoclave Process Control System
Process variables, temperature, pressure, flow, level and vacuum and their measurements. Elements of automatic process control systems. Elements of computer aided manufacturing (CAM).

11. Crystallization
Characterization of crystals and factors affecting them, supersaturation theory and its limitations, nucleation mechanisms, crystal growth, study of various types of crystallizer, tanks, agitated batch, Swenson Walker, single vacuum, circulating magma and crystal crystallizer, cacking of crystals and its prevention.

PRACTICALS
Total Hours: 100
Experiments based upon theoretical portion preferably on the following
1. Effect of thickness of filter media, hydrostatic pressure, size of filter media etc. on filtration rate.
2. Rate of drying, equilibrium moisture content, determination of factors affecting rate of drying.
3. Effect of number of balls and speed of ball mill on the grinding rate in ball mill.
4. Comparison of single stage and multiple stage extraction in solid-liquid extraction.
5. Study of Reynold's number and flow of fluids.
7. Determination of flow rate by Orifice and Venturimeters.
8. Calibration of pressure gauge with manometers.
10. Determination of efficiency of a steam distillation unit.
12. Determination of hardness of water.
13. Effect of driving fluids on efficiency of ejector pumps.
15. Factors affecting liquid displacement in air lift pumps.

Books Recommended:
1. J.F.Richardson and J.M. Coulron: Chemical Engineering
2. Walter L. Badger and J.T. Banchero: Introduction to Chemical Engineering
3. Perry: Handbook of Chemical Engineering
4. Lauer & Heckmann: Chemical Engineering Techniques
5. Peters: Elementary Chemical Engineering
6. S.J. Carter: Tutorial Pharmacy

Paper BPH 03
PHARMACEUTICS III
DISPENSING PHARMACY (THEORY)
Total Teaching Hours: 50

1. Prescriptions
Reading and understanding of prescriptions. Modern methods of prescribing and common Latin abbreviations.
2. Metrology
Reducing and enlarging recipes; percentage calculations, % w/v, v/v, and w/w, alcohol dilutions, use of alligation methods; proof spirit, isotonic solutions, mEq units, displacement value of suppositories.

3. Posology
Factors influencing dose. Calculations of doses on the basis of age, sex and surface area.

4. Powders
Types of powders, their merits and demerits, classification of powders, compounding, storage and packaging of powders requiring special consideration like effervescent powders, bulk powders, dusting powders, insufflations, dentifrices and cachets.

5. Liquid Dosage forms
Preparation, merits, demerits, solubility and methods of increasing solubility. Storage and packaging of liquid formulations for internal and external use.

6. Emulsions and Suspensions
**Emulsions** – Definition, types and identification tests, merits and demerits, uses and classification of emulsifying agents and preparation and stability of emulsions.
**Suspensions** – Definition, types, merits and demerits, use of suspending agents, flocculated and deflocculated suspensions, formulation and stability of suspensions.

7. Semi-Solid Dosage forms
**Ointments:** Classification of ointments and ointment bases. Factors governing selection of an ideal ointment base, preparation, packaging, labeling and storage of ointments.
**Pastes, Jellies, Poultries:** Formulation.
**Suppositories and Pessaries:** Types, suppositories bases, displacement value, preparation, packaging, labeling and storage.

8. Tablets
Types of tablets, merits and demerits, preparation methods, equipments, storage, packaging and evaluation of tablets.

9. Capsules
Hard and soft gelatin capsules, merits and demerits, preparation, storage, packaging and evaluation of capsules.

10. Sterile Dosage forms
Definition, types, merits and demerits. Elementary study of the formulation characteristics of the following types: Injectable preparations, opthalmic and ENT products, Total Parenteral Nutrition, dialysis fluids.
General requirements of sterile dosage forms. Handling, packaging, storage and dispensing of sterile dosage forms.

11. Introduction to Ayurvedic/Unani Tibb Dosage forms.

12. Incompatibility in Prescriptions
Physical, chemical and therapeutic incompatibility.

13. Labelling instructions and precautions while dispensing various dosage forms.

### PRACTICAL
Total Hours 100

1. **Student's Orientation**
Introduction to the laboratory equipment, weighing methodology, general instructions and handling of prescriptions, labeling instructions.

2. **Compounding and Dispensing of Prescriptions**
At least 50 prescriptions, representing the following classes of products, should be compounded and dispensed:
- Powders, capsules, tablets, mixtures, emulsions, lotions and liniments, ointments, creams, pastes, suppositories, ENT preparations, incompatibilities, miscellaneous products

3. **Current Patent and Proprietary Products**
A study of current patent and proprietary products. Students should be trained in patient counseling by discussing specific problems in major classes of patent and proprietary products. Study of the following classes of patent and proprietary products, generic and selected brand names, indications; contra-indications, adverse drug reactions, available dosage forms, dose and packing of (a) Antihypertensive drugs, (b) Antiamoebic drugs, (c) Antihistaminic, (d) Antiemetics, (e) Antacids and ulcer healing drugs,
(f) Anti-diarrhoeals and laxatives, (g) Respiratory drugs, (h) Antibiotics, (i) Analgesics and (j) Antipyretics.

4. **Prescription Reading:**

Minimum of 20 prescriptions from the clinical practice

5. **Legal and Ethical aspects of Dispensing and compounding of prescriptions**

The students should be trained about these aspects and evaluated by questionnaire.

**Books Recommended:**

1. Indian Pharmacopoeia, Govt. of India.
2. Remington’s Pharmaceutical Sciences.
11. Drugs Today
12. MIMS/CIMS

**Paper BPH 04**

**PHARMACEUTICAL CHEMISTRY I**

**ORGANIC CHEMISTRY (THEORY)**

**Total Teaching Hours: 50**

1. **Basic Principles and Concepts of Organic Chemistry**
   Polarity of bonds and molecules, dipole moment, resonance, inductive and electromeric effects, intramolecular and intermolecular hydrogen bonding, acids and bases.

2. **Stereochemistry**
   Stereoisomerism, optical activity, enantiomers, Diastereomerism, mesostructures, specification of R and S, D and L configuration, racemic modification and resolution of recemic mixtures, conformational analysis, geometrical isomerism, it’s nature of formation, nomenclature of isomers and determination of configuration.

Structure, nomenclature, preparation and reactions/properties of the following groups of compounds (including mechanism of reactions wherever necessary).

3. **Aliphatic & Alicyclic Hydrocarbons**
   Alkanes, alkenes, alkynes, cycloalkanes, Bayer strain theory

4. **Alkyl Halides**
   SN1 and SN2 reaction mechanism and stereochemistry, Dehydrohalogenation of alkyl halides, E1 and E2 mechanism, chloroform, carbon tetrachloride, trichloroethylene and halothane.

5. **Aliphatic Alcohols**
   (i) Primary, secondary and tertiary alcohol, methanol, ethanol, proof spirit, denatured alcohol, methylated spirit.
   (ii) Di and trihydric alcohols: glycols, glycerol, ethylene glycol, propylene glycol and dimercaprol.

6. **Ethers**
   Thioethers, divinyl ether, solvent ether, anaesthetic ether.

7. **Aldehydes and Ketones**
   Formaldehyde, acetaldehyde and their polymers, mechanism of aldol condensation, Classen
condensation, Cannizzaro’s reaction, Benzoin condensation, Perkin’s condensation, Witting reaction, Mannich reaction.

8. Saturated Monocarboxylic Acid
Formic acid, acetic acid and their derivatives, propionic acid, butyric acid, valeric acid, palmitic acid and stearic acid, ethyl nitrate, acylhalides, lactic acid, lactides, lactones and gluconic acid.

9. Di and Tricarboxylic Acids
Oxalic acid, malonic acid, succinic acid and their amide and imide derivatives, maleic acid and fumaric acid, malic acid, glutaric acid, tartaric acid, citric acid and adipic acid.

10. Aliphatic amines and related compounds
Alkylamines, β-hydroxy and β-alkylamines, diamines, urea and ureides, Hofmann’s rearrangement, differentiation of 1°, 2° and 3° amines, dextropropoxyphene hydrochloride, cramiphene hydrochloride, dicyclamide hydrochloride, mustine hydrochloride, cyclamic acid, thiambutosine.

11. Organometallic compounds
Grignard’s reagent their preparation and synthetic applications.

12. Carbanions
Reactions involving carbanions, malonic ester, synthesis of carboxylic acids, acetoacetic ester, synthesis of ketones, decarboxylation of β-ketoacids and malonic acids, direct and indirect alkylation of esters and ketones, alkylation of carbonyl compounds via enamines, α, β-unsaturated carbonyl compounds (conjugate addition) including Michael and Diels - Alder reaction.

PRACTICAL
Total Hours: 100

1. Lassaigne’s test for nitrogen, sulphur and halogens.
2. Identification of organic compounds based on solubility and functional group test.
4. Test for identity of selected drugs: atropine, caffeine, quinine, glucose, sucrose, ascorbic acid, aspirin and paracetamol.

Books Recommended

Paper BPH 05

PHARMACEUTICAL CHEMISTRY II
INORGANIC MEDICINAL PHARMACEUTICAL CHEMISTRY (THEORY)
Total Teaching Hours: 50

1. Sources of impurities in pharmaceutical substances
Importance of limit test and general principles and procedure for limit tests of chloride, sulphate, iron, arsenic, lead and heavy metals.

The following topics will be treated covering an outline of methods of preparation, tests for identity, assay procedure and pharmaceutical uses of compounds covered under following headings:

2. Pharmaceutical aids and necessities
Acids, bases, buffers, antioxidants, water and pharmaceutically acceptable glass.
3. **Major intra and extra cellular electrolytes**
   Major physiological ions, electrolytes used in replacement therapy, physiological acids-base balance, electrolytes used in acid-base therapy, electrolyte combination therapy.

4. **Essential and trace ions**
   Copper, zinc, iron, selenium, sulfur and iodine.

5. **Gastrointestinal agents**
   Acidifying agents, antacids, protective and absorbents, saline cathartics.

6. **Radiopharmaceutical used in medicine**
   Therapeutic application of isotopes, diagnostic application of isotopes.

7. **Topical agents**
   Antimicrobials and astringents.

8. **Dental products**
   Anticaries agents and dentifrices.

9. **Miscellaneous Inorganic Pharmaceutical agents**
   Inhalants; respiratory stimulants, expectorants and emetics, antidotes.

### PRACTICAL
**Total Hours: 100**

1. Limit tests for impurities in pharmacopoeial compounds.
2. Standardisation of sulphuric acid, hydrochloric acid, sodium hydroxide, potassium permanganate, sodium thiosulphate.
3. Quantitative analysis-assay of the following compounds will be done: solution of ammonia, boric acid, sodium bicarbonate, sodium carbonate, ferrous sulphate, strong and weak iodine solutions, copper sulphate, chlorinated lime, sodium chloride, ammonium chloride, sodium sulphate.

### Books Recommended
2. Pharmacopoeia of India, Govt. of India, Ministry of Health, Delhi.

### Paper BPH 06

**PHARMACOGNOSY I**

**PHARMACEUTICAL BIOLOGY (THEORY)**

**Total Teaching Hours: 50**

1. **Introductory Pharmacognosy**
   Historical development, modern concept and scope of Pharmacognosy. Significance of Pharmacognosy in various systems of medicine viz; Ayurveda, Unani, Homeopathic, Siddha and Allopathic systems practiced in India.

2. **Classification of crude drugs**
   Based on alphabetical, morphological, pharmacological, chemical and taxonomical methods, official and unofficial drugs, organized and unorganized drugs.

3. **Definition of drug**
   Sources of crude drugs viz; Herbs, Animals, inorganic matter, plant tissue culture and marine sources. Role of herbal drugs in national economy.

4. **Cultivation of herbal drugs.**
   Factors influencing variability in drug activity, type of soils, fertilizers, plant hormones and their applications, polyploidy, mutation and hybridization in medicinal plants.

5. **Production Factors**
   Factors involved in the preparation of herbal drugs for market from cultivated and wild sources including collection, drying, storage and transport methods.
6. **Study of morphological and histological characters of crude drugs**
   Ergastic cell inclusions, anatomical structures of bark, fruits, seeds and monocot and dicot stems, leaves and roots.

7. **Phytoconstituents of medicinal importance**
   Introduction, classification and chemical tests of: Carbohydrates, polysaccharides, mono-, di- and triterpenes, steroids, saponins, glycosides, flavonoids, phenolic compounds, tannins, carotenoids, alkaloids, iridoides and amino acids.

8. **Principles of plant classification**
   Diagnostic features and medicinal significance of important plants with special reference to:
   i) **Algae**: Rhodophyceae (Agar, Alginic acid, Diatoms, Carrageenan and Cetraria).
   ii) **Fungi**: Eumycetes (Ergot, Yeast, Mushrooms, Antibiotics, and Lycopodium).
   iii) **Gymnosperm**: Pinaceae (Turpentine, Colophony), Gnetaceae (Ephedra).
   iv) **Angiosperm**: Apocynaceae, Asteraceae, Convolvulaceae, Lamiaceae, Rubiaceae, Rutaceae, Solanaceae, Scrophulariaceae, Apiaceae, Leguminosae (Caesalpinaceae, Mimosaceae, Papilionaceae), Papaveraceae, Acanthaceae and Euphorbiaceae.
   v) **Pteridophytes**: Male fern.

9. **Techniques in microscopy**
   Details of mountants, clearing agents, chemomicroscopic reagents.

**PRACTICAL**

**Total Hours: 75**

2. Microscopical studies of basic tissues, bark, stem (Dicot, Monocot), Root (Dicot, Monocot), seed, leaf, fruits, trichomes, stomata, calcium oxalate crystals, starch, phloem fibres.
3. General chemical tests for alkaloids, glycosides, tannins, resins and proteins.
4. Study of diagnostic characters of families mentioned in the theory.

**Books Recommended**
2. AC. Dutta: Botany for Degree students, Oxford University Press, New Delhi.
4. P.K. Mukherjee: Quality Control of Herbal Drugs
5. C.K. Kokate, A.P. Purohit and S.B. Gokhle: Pharmacognosy
6. Jean Brunet: Pharmacognosy and Phytochemistry, Medicinal Plants

**Paper BPH 07**

**HUMAN ANATOMY & PHYSIOLOGY (THEORY)**

**Total Teaching Hours: 75**

1. **Introduction**
   i) Definition and scope of anatomy, physiology and related sciences. Anatomical terms in relation to parts of the body, system and organs.
   ii) Study of human skeleton.
2. **Cell**
   i) Structures and their functions.
   ii) Genetic control of cell function.
3. **Tissues of the Body**
   i) Types of tissues and their functions.
   ii) Physiology of muscle contraction.
   iii) Neuromuscular transmission.
4. **Membrane**
   i) General principles of membrane permeability transport.
   ii) Mechanisms and electrophysiology of membrane.
5. Nervous System
   i) General anatomy and physiology of neurons, synapses, neurohumoral transmission.
   ii) Central nervous system, its various parts and their functions.
   iii) RAS, Limbic system, Physiology of sleep, CSF, Sensory and motor pathway.
   iv) Autonomic nervous system.
   v) Reflex arc, conditioned and unconditioned reflexes.

6. Cardiovascular System and Blood
   i) Structures and functions of heart and blood vessels.
   ii) Heart sounds. ECG, Cardiac cycle, Blood pressure and its regulations.
   iii) Circulation (Pulmonary, Cerebral, Coronary, Placental and Foetal).
   iv) Lymphatic system.
   v) Blood composition and functions.
   vi) Blood groups, Rh factor, blood transfusion. (Immune mechanism).

7. Respiratory System
   i) Gross anatomy of respiratory passages.
   ii) Regulation and mechanism of breathing and pulmonary function test.
   iii) Transportation of gases.
   iv) Hypoxia, Anoxia, Dyspnoea, artificial respiration.

8. Digestive System
   i) Gross anatomy of the alimentary canal.
   ii) Physiology of digestion.
   iii) Liver and pancreas.

9. Endocrine System

10. Reproductive System
    i) Structure and function of male & female reproductive organs.
    ii) Spermatogenesis.
    iii) Puberty, ovulation, menstrual cycle, reproductive cycles.
    iv) Pregnancy, lactation, menopause and sex hormones.

11. Urinary System
    i) General disposition of organs of excretory system.
    ii) Physiological consideration of urine formation and factors controlling it.
    iii) Micturition.
    iv) Regulation of body fluid constituents and their volumes.
    v) Acid-base physiology: Hydrogen ion production, body buffer systems (bicarbonate, phosphate, and proteins), respiratory and renal regulation of acid base balance, correction of acidosis and alkalosis.

12. Special Senses
    i) Physiology of hearing, taste, smell and vision.
    ii) Structure and functions of skin.
    iii) Regulation of body temperature.

PRACTICAL
Total Hours: 100

1. Human Anatomy & Physiology
   i) Study of human skeleton and bones.
   ii) Study of models of organs of various body systems.
   iii) Study of surgical instruments.

2. Histology
   i) Handling of microscope
   ii) Identification of various tissues
3. Haematology
   i) Estimation of haemoglobin
   ii) Total RBC count
   iii) Total WBC count (TLC)
   iv) Differential leukocyte count (DLC)
   v) Platelets count
   vi) Determination of blood group and Rh factor.
   vii) Determination of ESR (demonstration)
   viii) Determination of blood clotting and bleeding time
   ix) Identification of plasmodium species in the human blood

4. Respiration
   Pulmonary function test using spirometer.

5. Nervous System
   Study of reflex action.
   Recording of body temperature by various techniques.
   Recording and interpretation of EEG.

6. Cardiovascular System
   Determination of blood pressure by palpatory and auscultating methods.
   Recording ECG and its interpretation.

Books Recommended:

Theory
2. C.C. Chatterjee: Human Physiology.
4. T.W.A. Glenister and Jean R.W. Ross: Anatomy and Physiology for Nurses

Practical
B-PHARM IIND YEAR
1. Condensation of the data collected; various forms of distribution tables.
2. Pictorial representation of frequency distribution in histograms and frequency polygons.
4. Measures of dispersion - range, mean deviation and standard deviation, coefficient of variation.
5. Significance tests - test of significance and chi-square test of significance.
6. Correlation between two variables.
7. Interpolation.
10. Limits of algebraic functions.
11. \( \lim \sin \theta \); axioms on limits; of trig. Functions.
12. Differential coefficient of a function; derivatives of \( x^2, \sqrt{x} \).
13. Derivative formula of sum and difference of two functions generalizing it for more than two; derivative of product of two functions generalizing it for the product of 3 functions; derivatives of quotient of two functions.
15. Derivative by method of substitution.
17. Derivative by method of substitution.
18. Parametric functions; implicit function; log. Differentiation.
21. Total differentials and total derivatives, higher order, partial derivative.
22. Tangent and normal, velocity and acceleration.
23. Approximate values, maxima and minima.
24. Derivation of formulae of integration from derivative formula.
25. Integration of sum and difference of two functions.
26. Integration by substitution, integration by parts.
27. The relationship of integration to summation.
28. Definite integration, interpretation of definite integration, as an area, area of circle.
29. R and B (beta) functions.
30. Double integrals, \( \int S.S (x,y) \) \( dydx \) over a particular region and its interpretation.
31. Ordinary differential equations of the first order.
32. Linear differential equations with constant coefficient.
33. Simultaneous differential equations.

Books Recommended
2. Prasad: Integral Calculus.
5. Ayers Mathematics and Stats for Students of Pharmacy.
1. Introduction
History of microbiology, its branches and its importance, general microbiological techniques, identification, staining and enumeration. General classification of microorganisms and study of bacteria, moulds, yeasts, viruses and actinomycetes -nutrition, cultivation, isolation and identification. Effect of moisture, temperature, ion, light and pH on the growth of micro-organisms; bacteriological media; bacterial metabolism - EMP and TCA pathways. Salient features of common communicable disease producing microbes. Study of different types of phase microscopy, dark field microscopy and electron microscopy. Bacterial resistance.

2. Immunology
Introduction, types of immunity, phagocytosis, antigens, antibodies, components; immune-systems humoral immunity, cellular immunity, privileged graft sites, graft host reaction; tolerance, immunogenetics; types of reactions and their application.
General method of the preparation of bacterial vaccines, toxoids, viral vaccine, rickettsial vaccines, antitoxins, serum-immune blood derivatives and other products relative to immunity. Interferon. Preparation and standardization of immunological products, e.g., BCG vaccines, diphtheria toxoids, small pox vaccine, poliomyelitis vaccine, tetanus anti-toxin and diagnostic biologicals.

3. Disinfection
Classification and mode of action of disinfectants, factors influencing disinfection, dynamics of disinfection; disinfectants, antiseptics and their evaluation.

4. Sterilization methods and Principles

5. Sterility testing of pharmaceutical products
Sterility testing of products according to IP, BP and USP. Sterility testing of parenteral products - solids, liquids, ophthalmic and other sterile products according to the I.P., B.P. and U.S.P. Sterility testing of sterile surgical devices, dressings, implants, absorbable, haemostats, surgical ligatures and sutures, surgical catgut.

6. Aseptic Technique
Designing of aseptic area, laminar flow equipments; study of different sources of contamination in an aseptic area and methods of prevention, clean area classification.

7. Fermentation Technology
Fermentation methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. Large scale production fermenter design and its various controls. Study of the production of - penicillins, citric acid, fungal diastase and dextran. A brief introduction to Recombinant DNA technology.

8. Microbiological Standardization

9. Microbial spoilage and preservation of Pharmaceutical products
Types of spoilage, factors affecting the microbial spoilage of pharmaceutical products, sources and types of microbial contaminants, assessment of microbial contamination and spoilage, preservation of pharmaceutical products using antimicrobial agents, evaluation of microbial stability of formulations.

10. Control of microbial contamination during manufacture
General aspects-environmental cleanliness and hygiene, quality of starting materials, process design, quality control and documentation.
PRACTICALS
Total Hours 100

Exercises illustrating the course contents of theory including:
1. Preparation of various types of culture media.
2. Studying of different laboratory equipments and processing, e.g., B.O.D. incubator, laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator, microscopes.
4. Various staining methods-simple, Grams staining and acid fast staining.
5. Isolation of pure culture of micro-organisms by multiple streak plate technique
6. Evaluation of antiseptic and disinfectants e.g. RWC, FDA method and chick martin.
7. Sterility testing-different methods as per IP/BP/USP
8. Hanging drop slide preparation.
10. Microbial viable count in a pharmaceutical product and total count of bacteria
11. Thermal death time determination.
12. Microbiological assay of antibiotics.
13. Isolation of an antibiotic producer.
14. Bacteriophage isolation and characteristics
15. Normal throat flora.
16. Studying of the environment micro flora and testing of aseptic area.
17. Antimicrobial activity of an unknown compound.
18. Microbiological standardization of raw materials.
19. Demonstration of slide preparations of various microorganisms.

Books Recommended
2. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Pelczar and Reid: Microbiology.
7. Rose: Industrial Microbiology.
8. Prescot and Dunn: Industrial Microbiology.
10. Cooper and Gunn’s: Tutorial Pharmacy
11. Peppler: Microbial Technology.
15. N.K. Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
16. PUBMED - on Internet (www.pubmed.com)

Physical Pharmacy
Total Teaching Hours: 75

1. Complexation and Drug action

2. Kinetic and Drug Stability
   Rates and orders of reactions, influence of temperature and other factors on reaction rates, decomposition and stabilization of medicinal agents, accelerated stability analysis.
3. Surface and interfacial phenomenon

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

5. Rheology
   Fundamentals of rheology- Introduction, types of flow, quantitative measurement of flow, mechanical models to illustrate viscoelasticity, thixotropy, measurement of thixotropy, thixotropy in formulations, rheology of disperse systems, application of rheology to pharmacy. Methods of measuring viscosity.

6. Micromeritics

7. Coarse Dispersions
   Suspensions - Interfacial properties of suspended particles, settling in suspensions, formulation of suspension. Emulsions- theories of emulsification, physical stability of emulsions, preservation of emulsions, rheologic properties of emulsions, phase equilibria and emulsion formulation.

8. Diffusion and Dissolution
   Steady state diffusion, procedures and apparatus, dissolution, drug release, diffusion principles in biologic systems, vapor sorption and transmission and thermodynamics of diffusion.

**PRACTICALS**
**Total Hours 75**

1. Preparation and properties of simple complexes.
2. Design, conduction and reporting of accelerated testing in studying chemical stabilization against hydrolytic decomposition of drugs.
3. Determination of surface and interfacial tension
4. Preparation and properties of colloids.
5. Viscosity determination of Newtonian and Non-Newtonian liquids by one point and multipoint viscometers.
6. Determination of HLB value of surfactant by saponification method.
7. Determination of HLB value by modified Griffin acacia emulsion method.
11. Determination of particle size by sedimentation method using and Andreasson pipette.
12. Determination of flow properties of powder through the tube as a function of length of tube, diameter of orifice of tube and pressure head.
13. Experiments demonstrating the measurement of angle of repose of powders and the factors affecting.
14. Determination of CMC (Critical Micelle Concentration) of surfactants by surface tension methods.
15. Experiments demonstrating the usefulness of solubilizing agent in forming a clear liquid phase of two immiscible liquids (Ternary phase diagram).
16. Qualitative and quantitative study of adsorption phenomenon.
17. Determination of bulk density of pharmaceutical solid.
18. Any other new experiment that can be included from time to time in support of the theoretical aspects of the course.
Books Recommended:

Paper BPH 11

PHARMACEUTICAL CHEMISTRY III
PHARMACEUTICAL ANALYSIS-1
INORGANIC CHEMISTRY (THEORY)
Total Teaching Hours:-50

1. Introduction
Significance of quantitative analysis in quality control, different techniques of analysis.

2. Acid-base titrations
Theories of acidimetry and alkalimetry, classification, direct titration of strong acids, weak acids, strong bases and weak bases.
Preparation and standardization of acids and bases. Some exercises related to the determination of acids & bases. Some official assay procedures, e.g., boric acid, hydrochloric acid, phosphoric acid, sodium hydroxide, calcium carbonate, ammonium hydroxide, nitric acid, sulfuric acid.

3. Oxidation & reduction titrations
Concepts of oxidation and reduction, redox reactions, strengths and equivalent weighs of oxidizing and reducing agents, redox indicators, potassium permanganate titrations, iodometry and iodimetry, ceric ammonium sulphate titrations, potassium iodate titrations. Pharmaceutical applications, preparation and standardization of redox titrants, e.g., sodium thiosulphate. Some exercises related to determination of oxidizing and reducing agents in a given sample shall be covered.

4. Precipitation titrations
Preparation and standardization of titrants like silver nitrate, ammonium thiocyanate; titrations according to Mohr's and Volhard's methods, ammonium and potassium thiocyanate titrations, indicators, applications in pharmaceutical analysis, Fajan's method and Gaylussac's method.

5. Diazotisation titrations
Different conditions involved in diazotisation of different amines, end point determination and pharmaceutical analytical applications such as in the assay of sulfonamides.

6 Gravimetric analysis
Introduction, precipitation techniques, supersaturation, coprecipitation, digestion, washing of the precipitates, filtration, paper and crucibles, ignition, specific examples of Gravimetric estimations like barium as barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate, magnesium as magnesium pyrophosphate. Other organic precipitants.

7. Non-aqueous titrations
Theoretical considerations, scope and limitations, acid base equilibria in non-aqueous media, titration of weak bases, titration of weak acids. Pharmaceutical products should be selected for illustration e.g. ephedrine, methyldopa and adrenaline acid tartarate.

8. Complexometric titrations
Types of Complexometric titrations, metal ion indicators, factors influencing the stability of complexes and applications e.g. calciumgluconate, bismuth carbonate, bismuth subnitrate, ligand’s and determination of hardness of water.

PRACTICAL
Total Hours: -100

1. Acid base titrations
Preparation and standardization of acids and bases, some exercises related to the determination of acids and bases separately and in mixture form. Some official assay procedures of boric acid, ascorbic acid shall also be covered.
2. Oxidation-reduction titration
Preparation and standardization of some redox titrants, e.g., potassium permanganate, potassium dichromate, iodine, sodium thiosulphate etc. Some exercises related to the determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving use of potassium iodate, potassium bromate, ceric ammonium sulphate shall be performed.

3. Precipitation titrations
Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, titrations according to Mohr's and Volhard's methods.

4. Gravimetric analysis
Determination of water of hydration, some exercises related to Gravimetric estimation of metal ions such as barium, magnesium and calcium shall be covered.

5. Diazotisation reaction
Assay of sulphonamides like wise any two official assays.

6. Complexometric titration
Any two official assays done by this method.

Books Recommended
3. Pharmacopoeia of India, Govt. of India, Ministry of Health, Delhi.

Paper BPH 12

PHARMACEUTICAL CHEMISTRY IV
ORGANIC CHEMISTRY (THEORY)
INCLUDING HETEROCYCLIC AND MEDICINAL CHEMISTRY
Total Teaching Hours: 50

1. Aromatic Compounds
Structure and resonance of benzene, aromatic character, mechanism of electrophilic aromatic substitution, orientation effects in electrophilic substitution, nucleophilic aromatic substitution.

2. Preparation, properties and actions of Phenols, sulphonic acids and derivatives, carboxylic acids, nitro compounds, amines, diazonium salts, aryl halides and ketones.

3. Polynuclear aromatic hydrocarbons
Naphthalene, phenanthrene and anthracene.

4. Heterocyclic compounds
Study of fundamentals of heterocyclics, nomenclature, methods of synthesis and important chemical reactions of the following:
   (i) Five-membered heterocycles
   Furan, thiophene, pyrrole, thiazole, oxazole, imidazole, pyrazole, triazole and tetrazole.
   (ii) Six-membered heterocycles
   Pyridine, pyridazine, pyrimidine, pyrazine and pyrones.
   (iii) Benz-fused heterocycles
   Quinoline, isoquinoline, indole, acridines and xanthone.

5. The following topic shall be treated covering outlines of synthetic procedures (of selected drugs), uses, and structure activity relationship including physicochemical, steric aspects and mode of action.
Vitamins, thyroid hormones and antithyroid drugs, coagulants and anticoagulants, expectorants and antitussives, antiseptics and disinfectants, diagnostic agents, hypoglycemic agents.
PRACTICAL
Total Hours: 100

1. Identification of organic compounds and preparation of simple derivatives.
2. Synthesis based on O-and N-acetylation, nitration and bromination.

Books Recommended
3. L.M. Atherden: Bentley and Driver's-Textbookof Pharmaceutical Chemistry, Oxford University Press, Delhi

Paper BPH 13

PHARMACOGNOSY II
GENERAL PHARMACOGNOSY (THEORY)
Total Teaching Hours: 50

1. Biosynthesis

2. Toxic Drugs
   Study of Allergens, hallucinogens, narcotics, mycotoxins, toxic mushrooms and Indian toxic plants.

3. Plant Products
   Introduction to plant bitters, sweeteners, health food, cosmetic and photosensitising agents.

4. Quantitative microscopy
   Determination of stomatal index, stomatal number, palisade ratio, vein islet number, vein termination number, Lycopodium spore method. Micrometers and measurement of microscopic characters.

5. Herbarium
   Preparation of herbarium sheets and their importance in authentication of plants.

6. Pharmaceutical aids
   Biological sources, chemical test and microscopy of: Cotton, silk, wool regenerated fibres, asbestos, kaolin, prepared chalk, and kieselghur.

7. Drugs of Animal origins
   Shellac, cochineal, cantharides, spermaceti, woolfat, lard, beeswax, honey, musk, lanolin, gelatin.

8. Enzymes
   Biological sources, preparation, characters and uses of Diastase, Papain Bromalain, Ficin, Yeast, Pancreatin, Urokinase, Pepsin, Trypsin, Pencillinase, Hyaluronidase and Stryptokinase.

9. Natural pesticides and Insecticides
   Tobacco, Pyrethrum, Cevadilla, Neem, Ryania. Introduction to herbicides, fungicides, fumigants and rodenticides.

PRACTICAL
Total Hours: 75

1. Identification through morphological, sensory and chemical characteristic of shellac, cochineal, cantharides, spermaceti, woolfat, lard, beeswax, honey, lanolin, gelatin, Yeast, Diastase, Papain, Bromalain, Cotton, Silk and Wool.
2. Quantitative microscopy of Vinca, Datura and Senna leaves.
3. Microscopic and chemical tests of the following powdered drugs:
   i) Leaf: Senna, Datura
ii) Stem: Ephedra
iii) Root: Rauwolfia, Glycyrrhiza
iv) Seed: Nux vomica, Plantago
v) Bark: Cinchona, Cinnamon
vi) Fruits: Fennel, Coriander
vii) Wood: Quassia,
viii) Rhizome: Ginger, Turmeric
ix) Flowers: Clove.

Books Recommended
8. Jean Brunet: Pharmacognosy and Phytochemistry, Medicinal Plants

Paper BPH 14

1. General aspect of Pathophysiology –
   Atrophy, necrosis, pain, irritation, inflammation, shock, allergy
2. Pathophysiology and Clinical Assessment
   i) Disorders of cells and tissues - hypoplasia, hyperplasia, hypertrophy, metaplasia, neoplasia and general considerations.
   ii) Disorders of blood cells - leukopenia, leukemia, erythrocyte disorders (anemia polycythemia), hemorrhagic diseases (thrombocytopenia, fibrinogen deficiency, purpura)
   iii) Disorders of blood vessels and heart - atheroma, arteriosclerosis, aneurysms, thrombophlebitis, embolism, varicose veins, congestive cardiac failure, ischaemic heart disease, rheumatic heart diseases, arrhythmia, hypertension, Burger's disease.
   iv) Disorders of the respiratory tract - tonsillitis, bronchitis, bronchial asthma, emphysema, cough.
   v) Disorders of the digestive tract - gastritis, peptic ulcers, pancreatitis, cirrhosis of the liver, jaundice
   vi) Disorders of the urinary system - glomerulonephritis, renal calculi
   vii) Disorders of the nervous system and special senses - Epilepsy, hypoxia, dementia, Parkinson's disease, chorea, Alzheimer's disease, migraine, depression, schizophrenia
   viii) Disorders of the reproductive system - Impotency, infertility, cryptorchism
   ix) Disorders of bone, joints and cartilages - Osteoporosis, gout, arthritis, rickets.
   x) Disorders of eye - glaucoma and cataract
3. Toxicology
   i) Definition, scope and its branches
   ii) Teratogenicity and Carcinogenicity
   iii) Toxicity of heavy metals and their antidotes
   iv) Management of poisoned patients
4. Health Education
   i) Spread and prevention of communicable disease- AIDS, sexually transmitted disease, small pox, measles, influenza, diphtheria, whooping cough, meningitis, tuberculosis, polio-myelitis, viral hepatitis, cholera, typhoid, diarrhea, amoebiasis, malaria, filariasis, rabies, tetanus, leprosy.
   ii) Control of population explosion, national family planning program means of contraception (mechanical, chemicals, surgical, Immunological, physical and physiological).
iii) Immunization – various vaccines, toxoids and their uses.

Books Recommended
2. H.E.A. Mentz: Pathophysiology in Medical Science.
5. Phillip J. Williams and James L. Burson: Industrial Toxicology.

Paper BPH 15

PHARMACOLOGY-I (THEORY)
Total Teaching Hours: 50

1. General Pharmacology
   i) Definition, scope and branches of pharmacology. Historical development with special reference to India.
   ii) Routes of drugs administration and drug delivery systems.
   iii) Dynamics of absorption, distribution and excretion of drugs.
   iv) Basic pharmacokinetic parameters employed in the use of drugs, their bioavailability and biotransformations, metabolizing enzymes as targets of drugs action (induction and inhibition).
   vi) Mechanisms of drugs action, drug receptors and cellular signaling systems.
   vii) Drug antagonism and synergism.
   viii) Drug dependence and related conditions.
   ix) Adverse drug effects and their monitoring, Iatrogenic diseases.
   x) Pharmacogenomics.

2. Pharmacology of Autonomic Nervous System
   i) Cholinergic receptors, cholinergic drugs (parasympathomimetics, cholinomimetics, anticholinesterases).
   ii) Anticholinergic drugs.
   iii) Adrenoceptors, sympathomimetics, adrenoceptors blockers.
   iv) Drugs action on autonomic ganglia (ganglionic stimulants, ganglion blocking agents).
   v) Neuromuscular blocking agents and centrally acting muscle relaxants.

3. Autocoids
   i) Histamine, Antihistaminics.
   ii) Serotonin, agonists and antagonists.
   iii) Arachidonic acid metabolites.
   iv) Renin Angiotensin Aldosterone System, Plasmakinins, VIP, neurotensin, substance P, PAF.

4. Drugs in Ocular Pharmacology
   i) Mydriatic and miotic agents and drugs used in glaucoma.

PRACTICAL
Total Hours: 100

1. Study of instruments used in experimental Pharmacology, smoking and fixing a kymograph.
2. Handling of laboratory animals.
3. Techniques of drug administrations in animals.
4. Influence of routes of administration of drugs on drug response.
5. Experiments on isolated tissue preparations.
   i) To record CRC of acetylcholine using guinea pig ileum / rat intestine.
ii) Determination of dose ratio.
iii) Study of competitive antagonism using acetylcholine and atropine.
iv) Potentiation of acetylcholine responses with anticholinesterases.
v) Determination of PD₂ value.

7. Determination of intraocular pressure in rabbits.

Books Recommended:

Theory

Practical
1. Pharmacological experiments on isolated preparations by Edinburgh University, Pharmacology Staff, 1968.

Paper BPH 16

COMPUTER APPLICATIONS
Total Teaching Hours: 25

1. Fundamentals of Computers
   Computers, its types and uses, computer generations, hardware, software, elements of a computer system.
   Number Bases - Decimal, binary, octal, hexadecimal, data representation.
   Storage devices - Primary memory, hard disk, floppy disk, CDROM.
   Input and output devices.

2. Operating System - DOS, Windows and Unix
   Operating system - definition, organization, functions, operations and types, history of DOS, Windows and UNIX operating systems, handling of drives, directories and files, commands - internal, external.
   Program groups, items, icons, clipboard, folders, task swapping.
   Major differences between DOS and UNIX operating systems

3. Data Transmission and Networks
   Hardware and software components. Seven layer model. Bus, star and ring topologies.

4. Programming
   High level languages, machine languages, syntax, semantics.
   Program design aims - Stages in programming, flow charts.

5. Programming Language ‘C’
   Data types, constants, variables, arithmetic and relational expression, symbolic constants, input and output, increment and decrement operators, assignment statement, if-else, switch statements.
   Loops - while, do-while, for-transfer statements, functions, header files, recursion, pointers and arrays, structures.

6. Application Software
   Wordprocessing techniques, file manipulations and formatting, printing setups, mail-merge. Table
handling. Mathematical equations, graphs, picture handling and drawings.
About spreadsheet programs, workbooks/worksheets, Formatting of sheets, Formulae and functions,
graphs. Import and export of files/data.
Presentation Packages, slide designing, graphs. Import and export facilities.

**PRACTICALS**
**Total Hours: 25**

MS Office—MS word. MS Excel. Powerpoint, DOS Commands.

**Books recommended**
B-PHARM IIIRD YEAR
Part I- Hospital Pharmacy
1. Status of health delivery systems in India
   Definition and role of hospitals in the health delivery systems. Types of hospitals.
2. Hospital Pharmacy
   Definition, functions and objectives of hospital pharmacy, location, layout and flow chart of material and men, personnel and facilities required including equipments.
3. Drug distribution system in Hospitals
   i) Out patients
   ii) In patients: Detailed discussion of
      (a) Unit dose dispensing
      (b) Floor ward stock system and satellite pharmacy services
      (c) Central sterile services, bed side pharmacy
   vi) Prepackaging.
4. OTC Counter
   Its establishment, dispensing, personnel, space, equipment, apparatus and other facilities required to achieve safe, efficient and speedy dispensing of drugs.
5. Maintenance of records of issue and use of narcotics and dangerous drugs, ward stock medicines and emergency drugs.
6. Medical Stores
   Objectives, layout facilities; procedures for procurement of drugs and supplies from medical stores depot, manufacturer, distributor, local market, procedure and limits of emergency purchase.
7. Pharmacy Therapeutics Committee
   Constitution and functions of Pharmacy therapeutics committee, hospital formulary system and its organization, functions and composition.
8. Drug Information service and drug information bulletin
9. Manufacturing of pharmaceuticals in hospitals
   Sterile Manufacturing: Large and small volume parenterals, facilities, requirements, layout, production planning, manpower requirements.
   Non-sterile manufacture: Liquid orals, external bulk concentrates.
10. Surgical instruments, hospital equipments and health accessories: Nomenclature and uses.

Part II- Clinical Pharmacy
11. Introduction to clinical pharmacy practice
   Definition and scope, common daily terminology used in the practice of medicine, functioning and working of clinical pharmacy unit, manpower requirements.
12. Pharmacists and patient counseling including specific examples
13. Drug interactions of clinical important drugs
   Definition and Introduction, Mechanism of drug interactions, Drug - Drug Interactions with reference to Analgesics, Diuretics, Cardiovascular drugs, Gastrointestinal agents, Vitamins and Hypoglycemic drugs.
14. Compliance to treatment and role of pharmacist
   Impact of diseases on drug action
15. Drugs in clinical toxicity
   Introduction, general treatment of poisoning, systemic antidotes. Treatment of poisoning due to insecticides, heavy metals, narcotics, barbiturates, organophosphorous compounds
16. Pharmaco-economics
   Diseases: Etiology, pathophysiology, manifestations and treatment of tuberculosis, hepatitis, rheumatoid arthritis, peptic ulcer, epilepsy, diabetes mellitus, atherosclerosis and hypertension.

Books Recommended
1. Remington’s Pharmaceutical Sciences.
2. W.E Hassan: Hospital Pharmacy.
4. Allwood and Fell: Hospital Pharmacy.

Paper BPH 18

PHARMACEUTICS-VII
FORENSIC PHARMACY AND ETHICS (THEORY)
Total Teaching Hours: 50

1. Historical Background
Drug legislation in India, Code of Ethics for Pharmacists.

2. Drug Laws
(A detailed study : Case study (actual/simulated) inclusive of recent amendments)
   i) Prevention of cruelty of animals act.
   ii) Pharmacy Act 1948.
   iii) Drugs and cosmetic Act 1940, Rules 1945.
   iv) Narcotic Drugs and Psychotropic Substances Act, and Rules there under.
   v) Drugs and Magic Remedies (Objectionable Advertisements) Act 1954.
   vii) Poison Act.
   viii) Factory Act.
   ix) Delhi shops and Establishment Act.
   x) Medical termination of pregnancy Act.
   xi) The Drug (price control) order.
   xii) The Insecticide Act.
   Xiii) Indian Patents Act as applicable to drugs and pharmaceuticals.

Books Recommended
1. N. K. Jain: Pharmaceutical Jurisprudence

Paper BPH 19

PHARMACEUTICS-VIII
PHARMACEUTICAL FORMULATION AND COSMETOLOGY (THEORY)
Total Teaching Hours: 50

1. Preformulation studies
   i) Study of physical properties of drugs like physical form, polymorphism, solubility, salt formation, dissolution and partitioning effects and their influence on formulation, stability and bioavailability of products.
   iii) Study of pro-drugs in solving problems related to stability, bioavailability and elegance of formulations.

2. Validation
Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets.

3. Blood Products and Plasma Substitutes
Classification of blood products; collection, processing and storage of whole human blood, concentrated human RBCs, dried human plasma, human fibrinogen, human thrombin, human normal immunoglobulin, human fibrin foam, plasma substitute, ideal requirements and large scale preparation of dextran.
4. **Radio Pharmaceuticals**
   Production of radiopharmaceuticals, radiation hazards, radiological safety, medical and pharmaceutical applications of radiopharmaceuticals.

5. **Raw materials used for Cosmetic preparations**
   Surfactants, humectants, preservatives, herbal materials, perfumes, colors.

6. **Hair Care Products**
   Introduction to hair structure, shampoos, hair conditioners, hair setting lotions, hair creams, hair bleaches and dyes.

7. **Skin Care Products**
   Introduction to anatomy and physiology of skin, formulation of skin cleansers and moisturizers, sunscreen products.

8. **Color Cosmetics**
   Lipsticks and nail lacquer.

9. **Dental Products:**
   Dentifrices, tooth powder and tooth paste.

10. **Personal Hygiene Products**
    Shaving soaps and creams, after shave preparations, antiperspirants and deodorants.

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**PRACTICALS**

**Total Hours 75**

**Preparation and quality control tests for:**

i) Cold cream  
ii) Vanishing cream  
iii) Cleansing lotion and cream  
iv) Moisturizing cream  
v) Hair creams  
vi) Hair setting lotions  
vii) Shampoos  
viii) Hair colorants  
ix) Shaving creams  
x) Tooth powders  
xi) Tooth pastes  
 xii) After shave lotions  
xiii) Other cosmetics  
xiv) Stability study of some formulations.

**Books Recommended**

8. L.Z. Benet: Biopharmaceutics as the basis for the design of drug products, In Drug Design.
12. Harry's Cosmetology
1. Ionisation and ionic equilibria
   Arrhenius theory, degree of ionisation and Ostwald dilution law, electrolyte and non-electrolytes, Debye-Huckel theory, buffer solutions and preparation of pharmaceutical buffer solution, approximate calculation of buffer capacity excluding the derivation of Vanslyke's equation of buffer capacity, buffers in pharmaceutical and biological systems, solubility products, hydrolysis of salts.

2. Solutions
   Colligative properties (Lowering of vapour pressure and Raoult's Law, osmosis and osmotic pressure, measurement of osmotic pressure, pharmaceutical applications of osmosis, theories of semipermeable membranes, elevation of boiling point and its experimental determination, depression of freezing point and its determination). Distribution law and solvent extraction method.

3. Catalysis:
   Homogeneous and heterogeneous catalysis, acid base catalysis, theories of catalysis, poisoning and applications of catalysis.

4. Thermodynamics
   First law of thermodynamics, work done in expansion of gases, internal energy, enthalpy, heat capacity.

5. Potentiometric analysis
   Electrodes and reference electrodes, potentials of galvanic cells, potentiometric acid-base titrations, potentiometric pH determination, precipitation and complexometric formation, oxidation-reduction titrations, applications in pharmacy.

6. Conductometric analysis

7. Aquametry
   Brief account of aquametry, physical and chemical methods for water determination, viz, Karl Fischer, spectrophotometric method, gas chromatographic and electrochemical methods.

8. Spectrofluorimetry

9. Chromatography
   Fundamental principles of chromatography, adsorption, partition, column, paper, thin-layer chromatography, gas chromatography and electrophoresis.

10. Polarimetry
    Principles and applications; polarization types of molecule analyzed; optical rotation; effects of concentration, wavelength, solvent, temperature on optical rotation; polarimeter, light source, sample cells.

PRACTICAL
Total Hours: 100

Experiments based on surface tension, viscosity, partition coefficient, kinetics, solubility product, and critical solution temperature. Exercises involving polarimetry, refractometry and pH-determination.

Books Recommended
1. J.R. Bannante: Physical Chemistry of Life Sciences, Printeil.
2. K.J. Laidler: Physical Chemistry with Biological Applications, Benjamin.
Paper BPH 21

PHARMACEUTICAL CHEMISTRY VI
MEDICINAL CHEMISTRY-I (THEORY)
Total Teaching Hours: 50

1. Principles of medicinal chemistry including drug absorption, metabolism, distribution and elimination.
2. Physico-Chemical properties of drugs in relation to biological activity.
3. Modern concepts of rational drug design: a brief introduction
4. The following topics shall be treated covering uses, structure activity relationship including physico-chemical and steric aspects and mode of action:
   i) Drugs Affecting the Central Nervous System
      General anesthetics, sedative-hypnotics, anticonvulsants, antipsychotics, anxioyltics, antidepressants, hallucinogens, antiparkinson agents, opiate analgesics, nonopiate analgesics, nonsteroidal anti-inflammatory agents.
   ii) Drugs Affecting the Peripheral Nervous System
       Local anesthetics, skeletal muscle relaxants.
   iii) Drugs Affecting the Autonomic Nervous System
       Adrenergic agents, antiadrenergic agents, cholinergic agents, anticholinergic and antispasmodic agents, histamine and antihistamines.
   iv) Drugs Affecting the Kidney
       Diuretics.
5. The outline of the synthetic procedure of the following drugs will also be covered:
   ii) Drugs acting on peripheral nervous system: Cocaine, Benzocaine, Lidocaine, Chlorphenesin, and Dantrolene Sodium.
   iv) Drugs acting on kidney: Acetazolamide, Dichlorphenamide, Chlorothiazide, Chlorothalidone, Ethacrynic acid, Furosemide, Spironolactone, Triamterene and Amiloride.

PRACTICAL
Total Hours:100

Synthesis of compounds of medicinal interest including synthesis involving two steps and synthesis of heterocyclic compounds.
Books Recommended


Paper BPH 22

PHARMACEUTICAL CHEMISTRY VII
NATURAL PRODUCT CHEMISTRY (THEORY)

Total Teaching Hours: 50

1. General methods of isolation of natural products, belonging to different groups.

2. Carbohydrates
   An account of the chemistry of mono, di- and polysaccharides: glucose, fructose, sucrose, maltose, lactose, cellulose, starch, glycogen, dextran and Chitin. Study of the naturally occurring glycosides (excluding cardiac glycosides) Indican ruberythric acid, amygdalin, salicin, sinigrin and arbutin.

3. Proteins and amino acids
   Classification, general methods of preparation and properties of amino acids, general nature of proteins, classification of proteins, End group analysis, Basic idea regarding primary, secondary, tertiary and quaternary structure of protein.

4. Terpenoids
   Classification, isolation and structure determination of some important terpenoids: Limonene, pinene, cineole, menthol, menthone, camphor, α-terpineol and citral.

5. Alkaloids
   Isolation, general methods of determination of structure, estimation of functional groups, structure elucidation and syntheses of some selected simple members, ephedrine, nicotine, atropine, cocaine, quinine, cinchonine, papaverine, morphine, reserpine.

6. Xanthine bases
   Introduction in relation to uric acid, isolation, structure determination and synthesis of caffeine, theophylline and theobromine.

7. Study of the chemistry of lipids (fats, oils and waxes), phospholipids.

8. Chemistry of Nucleic acid- Preliminary studies along with synthesis of purine and pyrimidine bases.

PRACTICAL

Total Hours: 100

1. Analysis of fixed oils:, determination of acid value, saponification value, iodine value, ester value and hydroxyl value.
2. Isolation of a few naturally occurring compounds such as caffeine, from tea leaves.
3. Estimation of following organic groups: hydroxyl (alcoholic and phenolic), amino, carboxylic groups and acetyl group.

Books Recommended

2. Pharmacopoeia of India, Govt. of India, Ministry of Health, Delhi.
1. **Carbohydrates**
   Biological sources, chemical constituents, adulterants and uses of:
   Starches, Acacia gum, Tragacanth, Sterculia, Guar gum, Plantago, Pectin, Sodium alginate, Agar, Bael, Honey.

2. **Lipids**
   Biological sources, chemical constituents, adulterants & uses of:
   Arachis oil, castor oil, sesame oil, cotton seed oil, olive oil, chalmooogra oil, shark liver oil, cod liver oil, neem oil, kokum bitter, rice bran oil, guggul lipids.

3. **Tannins**
   Biological sources, chemical constituents, chemical test and uses of: pale catechu, black catechu, Nutgalls, *Terminalia belerica*, *Terminalia chebula*, *Terminalia arjuna*.

4. **Volatile oils**
   Biological sources, chemical constituents, adulterants and uses of:
   Black pepper, Turpentine, Mentha, Coriander, Cardamom, Cinnamon, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Cumin, Caraway, Dill, Spearmint, Clove, Anise, Star anise, Fennel, Nutmeg, Eucalyptus, Chenopodium, Ajowan, Sandal wood, Palmarosa, Gauhteria.

5. **Resinous drugs**
   Classification, formation and chemical nature. Biological sources, chemical constituents, identification test, adulterants and uses of:
   Benzoin, Peru balsam, Tolu balsam, Colophony, Myrrh, Asafoetida, Jalap, Colocynth, Ginger, Turmeric, Capsicum, Cannabis, Podophyllum.

6. **Glycosides**
   Nature and classification. Biological sources, chemical constituents, adulterants and uses of:
   Digitalis, strophanthus, squill, thevetia, oleander, cascara, aloe, rhubarb, senna, quassia, dioscorea, quillaia, glyceryrthiza, ginseng, gentian, senega, ruta, wild cherry, withania, Bitter almond. Biosynthesis of Cardiac and Anthraquinone glycoside.

7. **Alkaloids**
   Biological sources, chemical constituents, adulterants and uses of:

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**PRACTICAL**

**Total Hours: 75**

1. Identification of organised drugs studied in theory on the basis of morphological and sensory characters.
2. Microscopy of:
   - Datura, Thevatia, Quassia, Cinchona, Ipecac, Nux vomica, Rauwolfia, Cinnamon, Caraway, Clove, Fennel, Aconite.
3. Chemical tests of:
   - Starches, Acacia gum, Tragacanth, Sterculia, Guar gum, Agar, Plantago, Sesame oil, Cotton seed oil, Pale catechu, Black catechu, Tannic acid, Clove, Cinnamon, Benzoin, Peru balsam, Tolu balsam, Colophony, Asafoetida, Aloe, Thevetia, Cinchona, Ipecac, Nux vomica, Ephedra, Colchicum.
4. Pharmacognosy tour for field collection of medicinal and aromatic plants. (2 Weeks)
5. Preparation of herbarium sheets and monograph on one of the collected plant during tour.

**Books Recommended:**

3. P.K. Mukherjee: Quality Control of Herbal Drugs
1. Drugs Acting on Central Nervous System
   i) Synaptic transmission in the CNS.
   ii) General anaesthetics, Dissociative and neurolept- anaesthesia.
   iii) Hypnotics and sedatives.
   iv) Alcohol.
   v) Antiepileptics.
   vi) Psychopharmacological agent.
   vii) Antiparkinsonian drugs.
   viii) Non-steroidal analgesics, anti-inflammatory and anti-pyretic agents, drugs used in gout.
   x) CNS stimulants and Nootropic agents.
   xi) Local anaesthetics.

2. Drugs Acting on Cardiovascular System
   i) Cardiac glycosides and positive ionotropic agents.
   ii) Antiarrhythmic drugs.
   iii) Antihypertensive drugs.
   iv) Coronary vasodilators and drugs used in angina.
   v) Hypolipidemic drugs.
   vi) Fibrinolytic agents.
   vii) Nitric oxide.

3. Drugs Acting on the Blood and Blood Forming Agents
   i) Coagulants.
   ii) Anticoagulants.
   iii) Haematinics (iron, vitamin B12 and Folic acid).
   iv) Plasma expanders.

4. Diuretics

5. Drugs Acting on Gastrointestinal System
   i) Purgatives.
   ii) Antidiarrhoeal drugs.
   iii) Antacids and treatment of peptic ulcers.
   iv) Emetics and antiemetics.
   v) Prokinetic agents.

6. Drugs Acting on Respiratory System
   i) Expectorants.
   ii) Antitussive bronchodilators.
   iii) Drugs used in common cold.

   PRACTICAL
   Total Hours: 100

1. Stages of chloroform and ether anesthesia with and without premedication.
2. Study of phenobarbitone induced hypnosis (Demonstration).
4. Study of anticonvulsant activity.
5. Study of local anesthetic activity.
   i) Surface anesthesia activity on rabbits.
   ii) Infiltration anesthesia using guinea pigs.
7. Seminars on the drugs studied in theory.

Books Recommended:

Theory
1. C.R.Craig and R.E.Stitzel: Modern Pharmacology

Practical
1. Pharmacological experiments on isolated preparations by Edinburgh University Pharmacology Staff, 1968.
2. Robert A.Turner and Peter Hebbom: Screening methods in Pharmacology, Vol.1 edited
5. Ian Kitchen: Text book of invitro Pharmacology

Paper BPH 25

BIOCHEMISTRY (THEORY)

Total Teaching Hours: 50

1. Enzymes
   i) Classification of enzymes.
   ii) General mechanisms of enzyme action.
   iii) Factors affecting the velocity of enzyme catalysed reaction.
   iv) Activators and inactivators of enzymatic reactions.
   v) Application of metabolic antagonism.

2. Biological Oxidations
   i) Oxidation-reduction chains in nature.
   ii) Oxidative phosphorylation.

3. Metabolism of Carbohydrate
   i) Anaerobic metabolism of Glucose.
   ii) Aerobic metabolism (Kreb's cycle).
   iii) HMP pathway.
   iv) Regulation of blood glucose concentration.
   v) Glycogenesis.
   vi) Glycogenolysis.
   vii) Gluconeogenesis.

4. Metabolism of Lipids
   i) Fatty acid metabolism.
   ii) Oxidation of fatty acids.
   iii) Biosynthesis of fatty acids.
   iv) Synthesis and degradation of triglycerides.
   v) Hormonal influence on the mobilisation of fat in adipose tissue.
vi) Ketosis.

5. **Metabolism of Proteins**
   i) Amino acid degradation and urea cycle.
   ii) Metabolism of tyrosine and Tryptophan.

6. **Protein Synthesis**
   i) Transmission and expression of genetic information.
   ii) DNA genetic role.
   iii) DNA Structure and replication.
   iv) RNA and transcription.
   v) Gene-protein relationship.
   vi) Control of Protein Synthesis.

7. **Metabolism of Nucleic Acids**
   Metabolism of purines and pyrimidines.

8. **Metabolism of Inorganic Elements**
   Calcium, Phosphorous, Magnesium, Trace elements.

9. **Basic Principles of Molecular Biology**
   Gene cloning: Restriction endonuclease, Restriction sites, Cloning vectors, Antibiotic marker gene, Application of DNA recombinant technology, DNA library.

**PRACTICAL**

**Total Hours: 50**

1. Estimation of glucose in blood.
2. Estimation of Liver glycogen.
5. Estimation of Chloride in Serum and Urine.
7. Determination of acid and alkaline phosphate.
8. Determination of SGOT and SGPT.
10. Estimation of RNA and DNA.
11. Determination of Serum bilirubin.
12. Electrophoretic separation of Serum proteins.
13. Fat determination in milk.

**Books Recommended**

**Theory**

1. Lubert Stryer: Biochemistry.

**Practical**

3. David T.Plummer: An Introduction to Practical Biochemistry.
B-PHARM IV TH YEAR
Paper BPH 26

PHARMACEUTICAL BIOTECHNOLOGY (THEORY)
Total Teaching Hours: 50

1. Genetic Engineering
   i) Brief introduction to biotechnology with reference to pharmaceutical sciences.
   ii) Basic principles of genetic engineering.
   iii) Recombinant DNA technology.
   iv) Application of genetic engineering in medicine.

2. Plant Biotechnology
   i) Protoplast isolation, protoplast fusion, somatic hybridization, applications of protoplast fusion.
   ii) Methods of gene transfer in plants. Agrobacterium mediated, direct gene transfer methods, use of marker and reporter genes, selection.
   iii) Applications of transgenic plants.

3. Animal Biotechnology
   i) Animal cell and tissue culture, media, transfection methods, application of transgenic animals.
   ii) Immunotechnology, Structure of immunoglobulins, vaccine development and immunization, Hybridoma and monoclonal antibodies.
   iii) Biopolymers and its types.
   iv) Applications of biopolymers.

4. Industrial and Microbial Biotechnology
   i) Enzyme Biotechnology- Methods of enzyme immobilization, bioreactors, Application of immobilized enzymes.
   ii) Brief introduction to Protein Engineering.
   iii) Immunotoxin and Drug designing.
   iv) Use of microbes in industry. Isolating and culturing of microorganism, microbial transformation.

Books Recommended
2. RA Goldshy et. al., : Kuky Immunology, (2001).

Paper BPH 27

PHARMACEUTICAL MANAGEMENT
Total Teaching Hours: 50

1. Personnel Management and Industrial Relations
   Objectives and functions of personnel department, employment and development of personnel. Industrial relations: problems of labor management relations, causes of industrial disputes, remedies, industrial dispute act, trade union grievance and grievance handling procedure, causes of grievances, need for grievance procedure, grievance redressal machinery.

2. Motivation

3. Communication
   Importance, nature of communication, types of communication- oral vs. written, media of communication. Barriers to communication. Communication failure. Achieving effective communication.
4. Purchasing and Store Keeping
Objectives, organisation and responsibilities of purchasing department, methods and types of purchasing-centralised and decentralised purchasing. Types of stores, depot, location and layout of a store, problems and development.

5. Materials management
Materials handling, equipment, inventory management, economic ordering quantity. ABC analysis, value analysis, classification and codification of stores, obsolete, surplus and scrap management, lead time, inventory carrying costs, safety stock, solutions to problems relating to EOQ.

6. Drug Supply
Planning and management, supply process and its pitfalls, planning for drug supply, planning models, steps to develop a formulary, predicting drug requirements, procurement cycle and its methods, designing training programs to improve pharmaceutical logistics.

7. Pharmaceutical Marketing
Goals, theories of selling process, company market, systems, market and sale forecasting, market test method, statistical demand analysis, types of sales organizations, salesmanship, qualification of a salesman, channels of distribution advertising, presentation and analysis of statistical data. (charts, frequency distribution).

8. Establishment of a pharmaceutical factory
Choice of site, trends in location of a plant, plant facilities, layout of stores in an industry, layout of injectable unit or sterile area, tableting department and area requirement for each department.

9. Production and Maintenance Management
A brief exposure of various functions and objectives of production management, various activities of production management, production organization, productivity and wastivity. Objectives of maintenance management, probability distributions, reliability engineering, preventive maintenance and its benefits.

Books Recommended
2. Personnel management and Industrial Relations, by R.S. Davar.

Paper BPH 28

PHARMACEUTICS -X
BIOPHARMACEUTICS AND PHARMACOKINETICS (THEORY)
Total Teaching Hours: 50

A. Biopharmaceutics
1. Introduction to biopharmaceutics, definition, historical development of the subject, fundamental principles, concepts and its role in formulation development and clinical setting.

2. Drug Absorption
Various mechanisms, factors affecting drug absorption-physicochemical, physiological and pharmaceutical.
3. Drug disposition
   Distribution in blood, plasma-protein binding, application of drug-protein binding.

4. Determination of bioavailability and bioequivalence:
   Measures of bioequivalence study and single dose bioequivalence study and relevant statistics, review of regulatory requirements for conducting bioequivalence study.

B. Pharmacokinetics

5. Introduction to pharmacokinetics, importance in bioavailability and clinical practice. Concepts, definition and explanation of terminologies used.

6. Compartment models - concepts and their importance in the study of pharmacokinetics.

7. One compartment open model. Determination of pharmacokinetic parameters from plasma and urine data after i.v. injection and oral administration. Percent absorbed time plot and absorption rates based on one compartment model.

8. Two compartment open model, pharmacokinetics of single and multiple dose administration as applied to intravenous (rapid) and oral administration, intravenous transformation. Dosage adjustment in patients with and without renal failure.


10. Extraction ratio, hepatic clearance, biliary excretion, extra hepatic circulation.


PRACTICALS
Total Hours 100

4. Disintegration and Dissolution of peroral tablets.
5. Influence of vehicle on drug availability from topical dosage forms in-vitro.
7. Evaluation of antacid products, by acid neutralizing capacity and Rosset-Rice test methods.
8. Comparative in-vitro release rate studies of marketed formulations.
11. Drug release from capsules, effect of diluents etc.
12. Effect of protein binding by egg albumin; dialysis method.
13. Determination of pharmacokinetic parameters, determination and evaluation of bioavailability of drug administered by IV, IM and P.O.
14. Practice numericals based on the portions covered under theory syllabus.

Books Recommended
5. R.E. Notari: Biopharmaceutics and Pharmacokinetics.
7. Rowland and Tozer: Textbook of clinical Pharmacokinetics
8. J. Swarbrick: Current concepts in Pharmaceutical sciences and Biopharmaceutics


**Paper BPH 29**

**PHARMACEUTICS -XI**

**PHARMACEUTICAL TECHNOLOGY (THEORY)**

**Total Teaching Hours: 50**

1. **Mixing**
   Fluid mixing, mechanism and types of flow, equipments. Solids mixing, mixing mechanism, equipment.

2. **Capsules**
   Hard gelatin capsules: Formulation of shell and contents, capsule production, filling, operation and equipment employed.
   Soft gelatin capsules: Manufacture, processing and quality control.

3. **Microencapsulation**
   Importance and application, techniques, equipment employed.

4. **Tablets**
   Production of tablets, additives and components, preparation of components for compression, forms of compressed tablets, evaluation.
   Tablet coating - Sugar coating, film coating, air suspension coating, film defects.

5. **Measurement of tablet punch forces**
   Transmission of forces through a powder. Distribution of forces within the powder mass, effect of pressure on the relative volume, adhesion and cohesion of particles strength of granules and tablets. Factors affecting the strength of tablets.

6. **Pharmaceutical aerosols**
   Components, formulation, types of systems, manufacturing, operation of an aerosol package, quality control and testing, oral, inhalation, nasal and topical aerosols. Future developments.

7. **Controlled drug delivery system**
   Introduction, terminology, drug targeting, design and fabrication of oral controlled release drug delivery system. Introduction to implantable and transdermal therapeutic system.

8. **Packaging technology**
   Types of containers, materials used, closures, unit dose packaging, strip packaging materials, packaging of solid, parenterals, and ophthalmic dosage forms, stability aspects of packaging.

9. **Good manufacturing practices for pharmaceuticals**
   Status and applicability of regulation, current good manufacturing practices in manufacturing, processing, packaging and holding of drugs, production and process controls, ISO 9000 certification.

**PRACTICALS**

**Total Hours 100**

1. Preparation of tablets by the following techniques:
   a. Wet granulation (Aqueous).
   b. Wet granulation (non-aqueous).
   c. Dry granulation (Slugging).

2. Coating of tablets - sugar coating and film coating.

3. Strip packing of tablets.

4. Quality control of tablets.

5. Filling and sealing of hard capsules.


7. Preparation of sustained release dosage forms employing various techniques.

8. Preparation of an aerosol dosage form and its evaluation.

9. Preparation and evaluation of microcapsules by employing various techniques.

10. Any other experiments illustrative of the theory of syllabus.
**Books Recommended**

15. World Health Organization’s guidelines on good manufacturing practices and inspection (available at http://www.who.int)
16. “Controlled drug delivery” (available at NC State University’s web sites http://www5.bae.ncsu.edu)

**Paper BPH 30**

**PHARMACEUTICAL CHEMISTRY-VIII**

**PHARMACEUTICAL ANALYSIS III (THEORY)**

Total Teaching Hours: 50

1. **Advanced chromatographic techniques**

2. **Visible and ultraviolet absorption spectrophotometry**
   - Principles of visual and UV absorption spectrophotometry, qualitative and quantitative analysis, Instrumentation.

3. **Nuclear Magnetic Resonance**
   - An introduction to the theory of NMR, chemical shifts, spin spin coupling, NMR instrumentation, structure elucidation of simple organic compounds and qualitative analysis of drugs

4. **Infrared spectrophotometry**
   - Origin of infrared spectra and regions, qualitative and quantitative analysis, instruments and applications.

5. **Mass spectrometry**
   - Basic principles, instrumentation, the mass spectra, types of ion, determination of molecular formula, molecular weight, fragmentation, mass spectra of some simple molecules.

6. **Atomic absorption spectroscopy**
   - Theory of absorption of radiant energy by atoms, equipment, and analytical applications.

7. **Flame photometry**
   - Theory of emission spectra, equipment, and qualitative and quantitative applications with reference to flame photometry.
8. Polarography
Introduction, theoretical consideration, organic polarography, dropping mercury electrode, basic principles of polarographic instruments, methods of analysis, experiments including amperometric titrations.

9. Different methods of analysis of following drugs related to functional group with particular reference to instrumental methods
i) Antibiotics: Nalidixic acid, ciprofloxacin, tetracycline, and chloramphenicol.
ii) Vitamins: Ascorbic acid, thiamine, vitamin A, 
iii) Barbiturates: Phenobarbitone.
iv) Sulphonamides: Sulfanilamide, sulphadiazine, and dapsone.
v) Steroids: Dexamethasone, prednisolone.

PRACTICALS
Total Hours 100

1. Experiments based on thin-layer and paper chromatography.
2. Analysis of as specified in Indian Pharmacopoeia.

Books Recommended

Paper BPH 31

PHARMACEUTICAL CHEMISTRY IX
MEDICINAL CHEMISTRY II (THEORY)
Total Teaching Hours: 50

The following topics shall be treated covering uses, structure activity relationship including physicochemical and steric aspects and mode of action:

1. Drugs affecting blood and the cardiovascular system
   i) Anticoagulants.
   ii) Antihyperlipidemics.
   iii) Cardiac glycosides.
   iv) Anti hypertensive agents.
   v) Vasodilators.
   vi) Antiarrhythmics.

2. Vitamins (excluding the detailed study of constituents).

3. Steroids
   Nomenclature, stereochemistry, classification, isolation methods, chemistry of cholesterol, diosgenin, stigmasterol, ergosterol, beta-sitosterol and steroidal alkaloids.

4. Hormones
   i) Sex Hormones And Analogs : Androgens and anabolic agents, estrogens and progestational agents (Oral Contraceptives).
   ii) Corticoids: Adrenocorticoids and glucocorticoids.
   iii) Prostaglandins.
5. Antiinfective and Antiinvasive Agents
   i) Antifungals.
   ii) Antiprotozoals.
   iii) Antimalarials.
   iv) Sulfonamides.
   v) Antibacterial quinolones.
   vi) Antibiotics.
   vii) Antiamoebic.
   viii) Antimycobacterial agents.
   ix) Anthelmintics.
   x) Antivirals.
   xi) Antineoplastic agents.

The outline of the synthetic procedure of the following drugs will also be covered

6. Cardiovascular Agents
   MethylDopa, Clonidine, Verapamil, Captopril, Enalapril, Propranolol, Atenolol, Phenoxybenzamine,
   Phenotamine, Hydralozine, Minoxidil, Sodium Nitropruside, and Tocainide.

7. Antiamoebics
   Metronidazole, Tinidazole and Diloxinide furoate.

8. Antitubercular
   Isoniazid, Pyrazinamide, Ethambutol, and Rifampicin.

9. Antiviral
   Amantadine, Idoxuridine and Ganciclovir.

10. Antihelmintic
   Mebendazole, Thiabendazole and Niclosamide.

11. Antineoplastic
    Thiotepa, Carmustine, Chlorambucil, Cyclophosphamide, and Mechlorethamine.

12. Antimalarials
    Chloroquine, Primaquine, Proguanil, and Amodiaquine.

13. Antityranosomal
    Pentamidine, Isothionate and Nifurtimox.

14. Antibiotics
    Doxycycline, Chloramphenicol, Carbenicillin and Cephalexin.

15. Antifungals
    Fluconazole, Tolnaftate and Clotrimazole.

16. Sulphonamides
    Sulphacetamide, Sulphanilamide, Sulphadiazine and Sulphamethoxazole.

17. Steroids and Hormones
    Diosgenin, Progesterone, Norethnodrel, Testosterone, Cortisone, Prednisolone, Triamcinolone,
    Diethylstilbestrol, Betamethasone, Aldosterone and Clomiphene.

PRACTICALS
Total Hours 100

Two or three step synthesis of some compounds of medicinal interest.

Books Recommended
PHARMACOGNOSY IV
INDUSTRIAL PHARMACOGNOSY (THEORY)

1. Isolation Techniques
   General methods used for the isolation and characterisation of alkaloids, lipids, glycosides, proteins, volatile oils, bioflavonoids, steroids, terpenoids and resins. Application of column, paper and thin layer chromatographic techniques for the isolation of phytopharmaceuticals.

2. Phytopharmaceuticals
   Isolation, characterisation and estimation of:
   Caffeine, Eugenol, Pectin, Solanine, Piperine, Tannic acid, Diosgenin, Hesperidine, Berberine, Calcium sennosides, Rutin, Glycyrrhizin, Menthol, Ephedrine, Quinine, Andrographolides, Guggul lipids and Katha industry in India.

3. Plant Biotechnology

4. Methods of adulteration
   Deterioration of herbal drugs by insect. Evaluation of drugs by organoleptic, microscopic, physical, chemical and biological methods. WHO guidelines.

5. Quality control and Standardization of herbal drugs
   Extractive values, ash values, chromatographic techniques (TLC, HPTLC and HPLC) for determination of chromatographic markers, spectroscopic techniques and assay methods. Determination of heavy metals in herbal preparation and alcohol contents in Aristas and bhasams; WHO guidelines.

6. Herbal formulations
   Principles involved in Ayurveda, Sidha, Unani, Chinese and Homeopathic systems of medicines, preparation of Ayurvedic formulations like Aristas, Asava, Ghutika, Churna, Ghrita, Ghrita and Bhasms; Unani formulations like Majoons, Safoofs.

7. Herbal cosmetics
   Shampoos (soapnut), Conditioners, (Amla, Henna, Hibiscus, Tea), Hair darkeners (Amla, Henna), Skin care (Aloe, Turmeric)

8. Traditional herbal drugs
   Common names, sources, active constituents and uses of:
   Punarnava (Boerhavia diffusa), Shankhpushpi (Convolvulus microphylla), Lehsun (Allium sativum), Guggul (Commiphora mukul), Kalmegh (Andrographis paniculata), Tulsi (Ocimum sanctum), Valerian (Valerian officinalis), Artemisia (Artemisia annua), Chirata (Swertia chirata), Asoka (Saraca indica), Saffron (Crocus sativa), Shilajit, Brahmi (Bacopa monnieri and Centella asiatica), Salai (Boswellia serrata), Giloe (Tinospora cordifolia).

9. Worldwide trade of crude drugs and volatile oils
   Plants based industries and research institutes. Intellectual Property Rights with special reference to phytoconstituents. Regulation pertaining to trade drugs.

PRACTICALS
Total Hours 100

1. Isolation and TLC profile of volatile oils of:
   Eucalyptus, Cumin and Lemon grass.

2. Isolation of Starch, Lipids, Resins, Tannic acids, Sennosides and Quinine.

3. Isolation and TLC profile of Total alkaloids:
   Nux vomica, Rauwolfia, Cinchona, Tea, and Vinca.

4. Herbal formulation of Shampoos.

5. Preparation and evaluation of herbal drugs.

8. Estimation of Citral, Carvone, Cineole, Balsamic acid, Quinine and Anthraquinone glycosides.

Books Recommended
2. Kirtikar and Basu: Indian Medicinal Plants.
3. Indian Pharmacopoeia.
4. Ayurvedic Pharmacopoeia.
5. British Pharmacopoeia.
6. www.chemexil.gov.in
7. www.camag.com

Paper BPH 33

PHARMACOLOGY-III (THEORY)
Total Hours: 50

1. Chemotherapy
   i) General principles of chemotherapy, General mechanism of action of chemotherapeutics agents.
   ii) Sulfonamides, Quinolones and other antibiotics (β-lactam antibiotic, aminoglycosides, macrolides, tetracyclines, chloramphenical, polypeptides).
   iii) Antiprotozoal drugs.
   v) Antimalarias.
   vi) Antiamoebics.
   vii) Urinary antiseptics
   viii) Antifungal and antiviral drugs.
   ix) Anti-helmintics.
   x) Chemotherapy of tuberculosis and leprosy.
   xi) Chemotherapy of cancer.
   xii) Immunomodulators.

2. Pharmacology of Endocrine System
   i) Pituitary hormones.
   ii) Thyroid - antithyroid drugs.
   iii) Insulin, oral hypoglycemics and glucagons.
   iv) Adrenocortical steroids and their antagonists.
   v) Sex hormones, contraceptives and drugs used in infertility.
   vi) Drugs regulating calcium homoeostasis, bisphosphonates.

3. Bioassays
   i) General principles and methods of Bioassays.
   ii) Official methods of bioassay of:
       Insulin, Heparin, Oxytocin, Vasopressin, ACTH, Glucagon, Gonadotrophin.

4. Evaluation of New Drugs
   i) Acute, subacute and chronic toxicity tests.
   ii) Teratogenicity and Carcinogenicity.
   iii) Clinical trials.

5. Vitamins
PRACTICALS
Total Hours 100

Bio-assay of following by using appropriate isolated tissue preparation: Acetylcholine, histamine, adrenaline, Oxytocin.

Books Recommended
Theory
5. R.S. Satoskar and S.D. Rhandarkar, Pharmacology and Pharmacotherapeutics.
9. Pharmacopoeia of India.

Practical
7. K.K. Pillai, Experimental Pharmacology, CBS, Delhi.