## VI Semester B.Pharm [Course and Examination Scheme with Credit Grade System]

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Hours per week</td>
<td>Theory</td>
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<td></td>
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<td>L   T   P</td>
<td>Duration of Paper (Hrs.)</td>
</tr>
<tr>
<td>BP601</td>
<td>Pharmaceutical Engineering-II</td>
<td>3    -    -</td>
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<tr>
<td>BP 602</td>
<td>Medicinal Chemistry-I</td>
<td>3    -    -</td>
<td>3</td>
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<tr>
<td>BP 603</td>
<td>Pharmaceutical Analysis III</td>
<td>3    -    -</td>
<td>3</td>
</tr>
<tr>
<td>BP 604</td>
<td>Pharmacology-IV</td>
<td>3    -    -</td>
<td>3</td>
</tr>
<tr>
<td>BP 605</td>
<td>Pharmacognosy –IV</td>
<td>3    -    -</td>
<td>3</td>
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<tr>
<td>BP 606</td>
<td>Quality Assurance</td>
<td>3    -    -</td>
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</tr>
<tr>
<td>BP 607</td>
<td>Pharmaceutical Engineering-II</td>
<td>-    -    4</td>
<td>2</td>
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<tr>
<td>BP 608</td>
<td>Medicinal Chemistry-I</td>
<td>-    -    4</td>
<td>2</td>
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<tr>
<td>BP 609</td>
<td>Pharmaceutical Analysis-III</td>
<td>-    -    4</td>
<td>2</td>
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<tr>
<td>BP 6010</td>
<td>Pharmacology-IV</td>
<td>-    -    4</td>
<td>2</td>
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<tr>
<td>BP 6011</td>
<td>Pharmacognosy –IV</td>
<td>-    -    4</td>
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<td><strong>Total</strong></td>
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<tr>
<td>SN</td>
<td>Topics</td>
<td>Hrs</td>
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<tr>
<td>02</td>
<td><strong>Crystallization</strong>&lt;br&gt;Crystal form, theories of crystallization, Equipment-Swenson walker, vacuum, agitated batch, Krystal crystallizer, caking of crystal.</td>
<td>08</td>
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<tr>
<td>03</td>
<td><strong>Drying</strong>&lt;br&gt;Mechanism, theory, factor affecting, Dryer- tray dryer, fluidized bed dryer, spray dryer, freeze dryer, vacuum dryer, drum dryer.</td>
<td>06</td>
<td></td>
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<tr>
<td>04</td>
<td><strong>Corrosion</strong>&lt;br&gt;Mechanism, factor influencing corrosion process, prevention &amp; control of corrosion.</td>
<td>06</td>
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<tr>
<td>05</td>
<td><strong>Evaporation</strong>&lt;br&gt;Theory, factor influencing evaporation, evaporator- pan, tubular (horizontal, vertical); climbing film, falling film, forced circulating, multiple effect evaporator- economy, and evaporator capacity.</td>
<td>10</td>
<td></td>
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<tr>
<td>06</td>
<td><strong>Environmental control</strong>&lt;br&gt;Air conditioning, refrigeration, Humidification and dehumidification, application to Pharmaceutical field.</td>
<td>05</td>
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</tr>
</tbody>
</table>
PHARMACEUTICAL ENGINEERING-II (BP-607)

Semester VI

PRACTICALS:
1. To study of rate of drying of solid sample (amorphous & crystal)
2. To study of drying behavior of solid sample( amorphous & crystal)
3. To study crystallization of sodium chloride with seeding
4. To study crystallization of sodium chloride without seeding
5. To study effect of viscosity on rate of evaporation.
6. Determine critical solution temperature of phenol water solution.
7. Plotting boiling point diagram for given mixture.
8. To study effect of pressure on rate of evaporation.
9. To study crystallization of boric acid with seeding.
10. To study crystallization of boric acid without seeding.
11. To study of effect of cooling on crystal growth.
12. To determine rate of heat loss through different material.
13. To determine free moisture content & bound moisture content.

REFERENCE BOOKS:
5. K. Sambamurthy-“Pharmaceutical Engineering”, New Age international Pvt Ltd.
<table>
<thead>
<tr>
<th>SN</th>
<th>Topics</th>
<th>Hrs</th>
</tr>
</thead>
</table>
| 01 | **Basic principles of medicinal chemistry:**  
     Structure of biological membrane, physicochemical parameters affecting drug action, drug absorption, distribution and elimination. Stereochemical aspects of drug action, drug receptor interaction including transduction mechanism, blood brain barrier. | 10  |
| 02 | **Drug metabolism:**  
     Phase I and phase II reactions, biological factors affecting drug metabolism, inducers and inhibitors of drug metabolism, significance of drug metabolism studies in drug development. | 05  |
| 03 | **Prodrug concept:** Principles of prodrug design and applications.     | 03  |
| 04 | Following topics shall be treated covering nomenclature, synthetic procedure of official drugs, uses and SAR including physicochemical and steric aspects and mode of action.  
   **Drugs Acting on CNS:** General and Local Anaesthetics, Sedative and hypnotics, Anticonvulsants, CNS Stimulants, Antidepresants. Drugs Used In Parkinsonism and Alzheimers Disease, Antipsychotics, Antianxiety.  
   **Drugs Acting on GIT:** Antacids, Emetics, Antiemetics, Purgatives, Antidiarrhoeals. | 24  |
| 05 | Introduction and applications of Green Chemistry.                      | 03  |

**Subject: Pharmaceutical Medicinal Chemistry-I (BP-608)**

**PRACTICAL:**

1. To perform pharmacopoeial assay of following drugs containing dosage form  
   Metoclopramide, Methadone, Chlorpromazine, Fluphenazine, Phenylbutazone, Thibendazon.
2. Synthesis of following compound by green chemistry  
   Acetanilide from aniline, Benzilic acid from benzil, Benzpinacol from Benzophenone, Benzpinacolone from Benzpinacol, 1,1-bis-2-naphthol from 2naphthol, Dihydropyrimidinone from benzaldehyde, Methyl ester from vegetable Oils.
REFERENCES:
1. Wilson and Gisvold’s Text Book of Medicinal Chemistry, Lippincott Williams and Wilkins.
2. Indian Pharmacopoeia, Government of India, Ministry of Health and Family Welfare, Published by the Controller of Publications and Information Directorate (CSIR), New Delhi
14. Kadam, Mahadik and Bothra “Advanced Practical Medicinal Chemistry”
<table>
<thead>
<tr>
<th>SN</th>
<th>Topics</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td><strong>UV-Visible Spectroscopy:</strong> Brief review of Electromagnetic Spectrum &amp; its properties. Absorption Law &amp; Limitations. Theory of Electronic Spectroscopy. The Chromophore concept, Choice of Solvent and Solvent Effects. Modern Instrumentation (Single Beam, Double Beam) Design, Working &amp; Principle, with significant emphasis on Source, Filters, Monochromators including Gratings, Sample Holder (Cuvette) and Detectors. Application of UV-Visible Spectroscopy (Qualitative &amp; Quantitative analysis) including Difference &amp; Derivative Spectroscopy.</td>
<td>10</td>
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<tr>
<td>02</td>
<td><strong>IR Spectroscopy:</strong> IR regions, Requirements for IR absorption. Basic Principle. Vibrational Frequency &amp; Factors influencing vibrational frequency. Fundamental Modes of Vibrations in diatomic molecule Instrumentation with significant emphasis on Sampling Techniques and Heat Detectors. Applications in identification of functional groups.</td>
<td>10</td>
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<tr>
<td>03</td>
<td><strong>Nephelometry and turbidimetry:</strong> Theory, Instrumentation and Application.</td>
<td>05</td>
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<td>05</td>
<td><strong>Amperometric titrations</strong> and its applications</td>
<td>04</td>
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<td>06</td>
<td><strong>Coulometry:</strong> Introduction, coulometry at controlled potential, coulometry at constant current, instrumentation and application.</td>
<td>04</td>
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<td>07</td>
<td><strong>Fluorescence spectroscopy:</strong> Fluorescence And Phosphorescence, Excitation and Emission Spectra, Factors Affecting Fluorescence Intensity, Instrumentation, Application, Determination of Quinine Sulphate, Thiamine Hydrochloric Acid.</td>
<td>05</td>
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<td>08</td>
<td><strong>Flame photometry:</strong> Theory, Instrumentation and Applications.</td>
<td>03</td>
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</tbody>
</table>

**Subject: Pharmaceutical Analysis III (BP-609)**

**PRACTICAL:**
3. To study the effect of solvent & pH on UV spectrophotometer of a given compound.
5. Assay of Metformin Tablets using UV Spectrophotometer.
10. Demonstration of IR spectrophotometer.
11. To study IR spectra of given compound(s)
12. Identification of functional group by IR.
13. Determination of sodium concentration by flame photometry
14. Determination of potassium concentration by flame photometry

REFERENCES:

5. Indian Pharmacopoeia, Government of India, Ministry of Health and Family Welfare, Published by the Controller of Publications and Information Directorate (CSIR), New Delhi
13. G. R. Chatwal And Shyam K. Anand “instrumental methods of chemical analysis”
### B.Pharm-III (Semester- VI)
#### Pharmacology-IV (BP-604)

<table>
<thead>
<tr>
<th>SN</th>
<th>Topics</th>
<th>Hrs</th>
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<tbody>
<tr>
<td>01</td>
<td>Study of Pharmacological action of following classes of drug with respect to classification including recently available drugs, mechanism of action, receptors, adverse effects, Drug interaction, contraindication and therapeutic uses:</td>
<td>10</td>
</tr>
<tr>
<td>02</td>
<td><strong>Pharmacology of drug acting on endocrine systems</strong></td>
<td>10</td>
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<tr>
<td></td>
<td>A. Pituitary hormone and regulation of secretion</td>
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<td>B. Thyroid hormone, Anti-Thyroid agents</td>
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<td>C. Parathyroid hormone, calcitonin, vitamin D.</td>
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<td>D. Insulin, Oral Hypoglycemic agents</td>
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<td></td>
<td>E. Adreno-corticoids, Anabolic Steroids and Fertility Agents</td>
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<tr>
<td>03</td>
<td><strong>Chemotherapy of microbial infection</strong></td>
<td>24</td>
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<tr>
<td></td>
<td>A. Introduction</td>
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<td></td>
<td>B. Penicillin and cephalosporin’s</td>
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<td></td>
<td>C. Macrolides and Amino Glycosides and Polypeptides</td>
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<td>D. Quinolones and Fluoroquinolines</td>
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<td>E. Chemotherapy of Fungal Infections</td>
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<td>F. Chemotherapy of Viral Infections</td>
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<td>G. Chemotherapy of Malaria</td>
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<td></td>
<td>H. Chemotherapy of Tuberculosis and Leprosy</td>
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<tr>
<td></td>
<td>I. Pharmacology of Anthelmintics</td>
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<td></td>
<td>J. Anti-Neoplastic agents</td>
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<tr>
<td>04</td>
<td><strong>Drugs acting on Immune system:</strong></td>
<td>03</td>
</tr>
<tr>
<td></td>
<td>A. Immunostimulants</td>
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<td></td>
<td>B. Immunosupressant</td>
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<tr>
<td>05</td>
<td><strong>Clinical trial:</strong></td>
<td>08</td>
</tr>
<tr>
<td></td>
<td>A. Designs used in clinical trials with their advantages and disadvantages, hypothesis, risks and benefits, subject selection, inclusion and exclusion criteria, randomization, blinding and controls.</td>
<td></td>
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<td></td>
<td>B. Management of Clinical trials: Role and responsibilities of Stakeholders of clinical trials such as FDA, CRO, Sponsor, Physicians, Nurses, Health professionals, Hospitals, Patient.</td>
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<td></td>
<td>C. Guidelines for clinical research: ICH-GCP.</td>
<td></td>
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</tbody>
</table>
Pharmacology-IV (BP-6010)

PRACTICAL:
1. To determine pA₂ value of antagonist using different tissues isolated from rats.
2. To study antipsychotic activity by using conditioned avoidance response.
3. To study antiparkinson activity using catalepsy test.
4. Demonstration of ED₅₀ determination of some drugs in rats or mice.
5. To study learning memory enhancing activity using radial arm maze.
6. To study learning memory enhancing activity using water maze.
7. To study learning memory enhancing activity using elevated plus maze.
8. To study addiction and abuse liability of some drugs.
9. To study analgesic activity using acetic acid induced writhing.
10. To demonstrate BP of rats by non invasive method
11. To demonstrate ECG and EEG of rats by non invasive method.

References:
7. Maickel, Pradhan, Pharmacology in Medicines – Principles and Practice. SP Press International INC.
13. Remington’s Pharmaceutical Science and practice pharmacy. Lippincott Williams and Wilkins, New Delhi
## Glycosides

<table>
<thead>
<tr>
<th>Hrs</th>
<th>Topics</th>
</tr>
</thead>
</table>
| 12  | a. Introduction, definition, occurrence, properties, classification, uses, general biosynthetic pathways, General extraction and isolation method.  
b. Pharmacognostic study of following drugs  
  Anthraquinones: Senna, Aloe, Rhubarb  
  Cardioactive: Digitalis, Squill, Strophanthus  
  Saponins: Liquorice, Dioscorea, Shatavari  
  Bitter: Quassia, Kalmegh  
  Cynogenetic: Bitter almond  
  Isothiocyanate: Black mustard  
  Flavonoid: Orange peels |

## Resins:

| 10  | A) Introduction, Classification, Physical & Chemical properties, occurrence/distribution, General extraction methodology and analysis of resins.  
   Biological source, collection, preparation, chemical constituents, Identification tests, uses, adulterants and substituents of following:  
   Asafoetida, Guggul, Podophyllum, Capsicum, Turmeric, Cannabis and Ginger.  
   B) Biological source & Uses of following Balsam of Tolu, Balsam of Peru, Benzoin ,Myrrh, Storax, Colophonys & Jalap. |

## Tannins

| 08  | a. Introduction, definition, classification, properties, uses, chemical tests and general method of extraction.  
b. Pharmacognostic study of following drugs  
  Pale catechu, Black catechu, Ashoka, Arjuna, Bahera, Amala, Myrobalon, Galls |

## A study of structural elucidation of following phytoconstituents –

Camphor, eugenol,  
Eugenol, cineole, camphor, menthol, citral

## Isolation, purification & chromatographic profiles of following

Eugenol, cineole, camphor, menthol, citral

## Marine Drugs-

Introduction, classification and studies of categories of marine drugs  
Anticancer, Cardiovascular agents and marine toxins.
**Pharmacognosy IV (BP-6011)**

**PRACTICAL:**
1. Demonstration of percolation and continuous extraction technology (Soxhlet extractor)
2. Determination of total content of tannins from Black catechu.
3. Extraction of total sennosides from Senna leaves.
4. Study of morphological and microscopical characters of –
   a) Senna  
   b) Digitalis  
   c) Liquorice  
   d) Shatavari  
   e) Quassia  
   f) Kalmegh
5. Chemical test of resinous crude drugs. ex: Asafoetida, Guggul, Turmeric, Tolu and Peru balsam, Myrrh.
6. Determination of balsamic acids in Tolu or Peru balsam
7. Extraction of ginger OR capsicum oleo resin
8. To determine vein-islet number, vein-termination number, stomatal index of given sample.

**Reference Books**


<table>
<thead>
<tr>
<th>SN</th>
<th>Topics</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Basic concept of Quality Control &amp; Quality Assurance, Total Quality Management, Philosophy of GMP, GLP, ISO and introduction to ICH guidelines.</td>
<td>05</td>
</tr>
<tr>
<td>02</td>
<td>Quality Control Laboratory: Responsibilities, routine controls, instruments, protocols, standard test procedure sampling plans etc. Quality control documentation and audits of QC facilities.</td>
<td>05</td>
</tr>
<tr>
<td>03</td>
<td>Quality Control in Pharmaceutical Industries - Introduction to validation – Equipment, Method, Personnel and Process validations, Validation of water and air handling systems.</td>
<td>05</td>
</tr>
<tr>
<td>04</td>
<td>In process quality control on various dosage forms. Standard Operating Procedures for operations like cleaning, filling, drying, compression, coating, sterilization etc.</td>
<td>05</td>
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<tr>
<td>05</td>
<td>Concept and historical development of pharmaceutical product registration. Effect of GATT and WTO with regard to pharmaceuticals.</td>
<td>05</td>
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<tr>
<td>06</td>
<td>Regulations, requirements, procedures and application of new drug approval process: Preclinical studies, Brochure preparation for IND and ANDA. Clinical research protocols.</td>
<td>05</td>
</tr>
<tr>
<td>07</td>
<td>Regulatory requirements – European community, United State, Japan, India and other territories. New Developments in regulatory affairs across the world with regard to WHO and ICH guidelines.</td>
<td>07</td>
</tr>
<tr>
<td>08</td>
<td>Introduction to Intellectual Property Right. Introduction Understanding Intellectual property rights (IPR) and review of IPR regime: - Copyrights, Trademarks, Geographical indications,</td>
<td>08</td>
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References Books: