**Dr. H. S. Gour Central University Sagar (MP)**
**Proposed Curriculum for B. Pharm. Course**
*(Structure of courses)*

**B. Pharm. Course : Fourth Year (VII Sem. & VIII Sem.)**
*(Structure of courses)*

<table>
<thead>
<tr>
<th>Department</th>
<th>Dept. of Pharmaceutical Sciences</th>
<th>Course</th>
<th>B.Pharm.</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td>Pharmaceutical Sciences</td>
<td>Subject Code</td>
<td>PHS-54</td>
<td>School</td>
</tr>
</tbody>
</table>

**B.Pharm. – VII SEMESTER (Theory & Tutorials)**

<table>
<thead>
<tr>
<th>Course S. No</th>
<th>Course Code</th>
<th>Course Name</th>
<th>L*</th>
<th>T*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>PHSC 7101</td>
<td>Medicinal Chemistry III</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>02</td>
<td>PHSC 7102</td>
<td>Pharmaceutical Analysis III</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>03</td>
<td>PHSC 7103</td>
<td>Pharmacology III</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>04</td>
<td>PHSC 7104</td>
<td>Drug Legislation and Regulatory Affairs</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>05</td>
<td>PHSC 7105</td>
<td>Clinical &amp; Hospital Pharmacy</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total=** 18 0 18

**B.Pharm. – VII SEMESTER (Practicals)**

<table>
<thead>
<tr>
<th>Course S. No</th>
<th>Course Code</th>
<th>Course Name</th>
<th>P*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>PHSC 7106</td>
<td>Medicinal Chemistry III</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>02</td>
<td>PHSC 7107</td>
<td>Pharmaceutical Analysis III</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>03</td>
<td>PHSC 7108</td>
<td>Pharmacology III</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>04</td>
<td>PHSC 7109</td>
<td>Clinical &amp; Hospital Pharmacy</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total=** 15 5

**Note:** * L - Lecture  T – Tutorial  P – Practical  C - Total Credit

Disclaimer: This information is uploaded on website (as on date) for immediate reference only. Please crosscheck and verify with the duly signed hard copy available with the concerned departmental office / library to be aware about any upgradation or correction in the syllabus/scheme taken place time to time, as and when needed.
### Dr. H. S. Gour Central University Sagar (MP)

**Proposed Curriculum for B. Pharm. Course**

(Structure of courses)

<table>
<thead>
<tr>
<th>Department</th>
<th>Dept. of Pharmaceutical Sciences</th>
<th>Course</th>
<th>B.Pharm.</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject</td>
<td>Pharmaceutical Sciences</td>
<td>PHS-54</td>
<td>School</td>
<td>EAT</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

#### B.PHARM. – VIII SEMESTER (Theory & Tutorials)

<table>
<thead>
<tr>
<th>Course S. No</th>
<th>Course Code</th>
<th>Course Name</th>
<th>L*</th>
<th>T*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>PHSC 8101</td>
<td>Novel and Controlled Drug Delivery Systems</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>02</td>
<td>PHSC 8102</td>
<td>Biopharmaceutics &amp; Pharmacokinetics</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>03</td>
<td>PHSC 8103</td>
<td>Pharmacognosy and Phytochemistry -IV</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>04</td>
<td>PHSC 8104</td>
<td>Elective</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>15</td>
<td>0</td>
<td>15</td>
</tr>
</tbody>
</table>

#### B.PHARM. – VIII SEMESTER (Practicals)

<table>
<thead>
<tr>
<th>Course S. No</th>
<th>Course Code</th>
<th>Course Name</th>
<th>P*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>PHSC 8105</td>
<td>Novel and Controlled Drug Delivery Systems</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>02</td>
<td>PHSC 8106</td>
<td>Biopharmaceutics &amp; Pharmacokinetics</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>03</td>
<td>PHSC 8107</td>
<td>Pharmacognosy and Phytochemistry -IV</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>04</td>
<td>PHSC 8108</td>
<td>Project on elective</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>15</td>
<td>05</td>
</tr>
</tbody>
</table>

**Note:**

*L - Lecture  T – Tutorial  P – Practical  C - Total Credit*

**PHSC 8104 Electives (T)**
1. GMP, Quality Assurance
2. Packaging Technology
3. Drug Design
4. Drug Interactions
5. Neutraceuticals
6. Herbal Drug Technology

Disclaimer: This information is uploaded on website (as on date) for immediate reference only.
Please crosscheck and verify with the duly signed hard copy available with the concerned departmental office / library to be aware about any upgradation or correction in the syllabus/scheme taken place time to time, as and when needed.
B.PHARM. VII SEMESTER (Theory & Tutorials)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7101</td>
<td>Medicinal Chemistry-III</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Hours Per Week</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Medicinal Chemistry-III**

**Theory: 4h/week**

1. Principles of drug design: Traditional analogue, quantitative structure activity relationship (QSAR) and mechanism based approaches. A brief introduction to graph theory, application of mechanism based approaches. Application of quantum mechanics, computer aided drug designing (CADD) and molecular modelling. Introduction to QSAR

2. Prodrug design

1. Vitamins excluding detailed study of constitution.

   1. Metabolite antagonism-basic concepts, active site directed irreversible enzyme inhibitors, mechanism based enzyme inhibitors, dihydrofolate synthetase inhibitors, dihydrofolate reductase inhibitors, amino acid antagonists, antagonists directed against nucleic acids, β-lactamase inhibitors.

   2. The following topics shall be treated covering chemical naming, structure activity relationship, physicochemical and stero aspects, mode of action and uses. The emphasis would be only on BP and IP compounds. Synthesis of only those drugs given in parentheses under each topic would be covered.

3. Sulphonamides, development, nomenclature and classification, antimicrobial spectrum, drug resistance, synergism with dihydrofolate reductase inhibitors, toxicity and side effects, reduction of crystal urea, physicochemical properties and biological activity, protein binding and distribution, metabolism, sulphonamides and trimethoprim combination (sulphanilamide, sulphacetamide, sulphasalazine, sulphadimethoxine, sulphamethazole and sulphasalazine).

4. Antibiotics- classification, cycloserine, chloramphenicol, penicillins, cephalosporins, aminoglycosides, tetracyclines, polypeptides (chloramphenicol)

5. Antimycobacterial agents- Introduction to mycobacterium, development of antimycobacterium agents and their use in therapeutics (dapsone, sulfoxone sodium, solapsone, isonicotinic acid hydrazide, para aminosalicylic acid, pyrazinamide and ethionamide)

6. Antimalarials: Quinoline and analogues, 8-amino quinolines, 9- amino acridines, 4- amino quinolines, diamino pyrimidine, biguanides (primaquin, mepacrine, chloroquin, pyrimethamine)
7. Antiamoebic agents: Emetine hydrochloride, quinoline derivatives, metal free substances, diloxanide furoate, metronidazole, organometallic compounds, acetarsol (diodohydroxyquinoline, diloxanide)

8. Drugs used for trypanosomiasis and other protozoal diseases

9. Anthelmintics drugs used in cestide infections, drugs used in trematode infections, drugs for intestinal nematode infections, antifilarial agents (niclosamide, hexylresorcinol, diethylcarbamazine citrate, thiabendazole)

10. Antifungal agents, antibiotics, griseofulvin, amphotericin, candididine, nystatin, synthetic antifungal agents, salicyclic acid, miconazole elcomazole, tolanflate, flucotosine, dithranol and chlorphenesin

11. Urinary antiseptics quinolones, nalidixic acid, nitrofurantion

12. Disinfectants and antiseptics

13. Antineoplastic agent- Introduction, characteristic of cancer cell, cell growth cycle, causes of cancer, antimetabolites, 6-thioguaine, methotrexate, 6-mercaptopurine, cytarabine, 5-flourouracil and dacarbazine, alkylating agents, mechloretamine, melphalan, busulphan, mitomycin, cisplatin, thiotepa, chlorambucil, carmustine, lomustine, cyclophosphamide, DNA intercalating agents, doxorubicin, daunorubicin, mitoxantrine, antibiotics, dactinomycin, bleomycin, mithramycin, anthramycin, antimitotic agents, vincristine, vinblastine, miscellaneous agents, procarbazine, asparaginase, interferones, hydroxyurea.


15. Diagnostic agents

BOOKS RECOMMENDED

7) Malone, Dyson and Purey, May’s Chemistry of Synthetic Drugs.
8) Singh H.K., Kapoor, V. K., Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, New Delhi
B.PHARM. VII SEMESTER (Theory & Tutorials)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7102</td>
<td>Pharmaceutical Analysis III</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Hours Per Week</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pharmaceutical Analysis III**

**Theory: 4h/week**

5. Electromagnetic radiations – Nature of electromagnetic radiations, the interaction between energy and matter, applications of quantum mechanics theory, the absorption of energy by atoms and molecules, the emission of radiant energy by atom and molecules: refraction and diffraction.

6. Ultraviolet and Visible spectrophotometry- Electronic excitation, quantitative laws, deviation from beers law, graphical presentation of data, chromophores, photometric errors, instrumentation (light sources, prism, & grating, monochromators, photoemissive & photomultipliers tubes), single& double beam instruments, steps in spectrophotometric measurements (sample handling; amplification and radiation of detectors, selection of wavelengths & bandwidth), concentration and optimum absorbance value, applications (direct & indirect methods, analysis of mixture).

7. Fluorometric analysis- Theory, quantitative description, experimental factors effecting fluorescence intensity, factors effecting $I_0$ & f directly, relationship of fluorescence to molecular structure, instrumentation (cells, light sources, wavelength selection, detectors), correction of spectra, pharmaceutical applications.

8. Flame photometry- Origin of spectra, atomization and ionization, instrumentation (nebulizer, mirrors, burners, slits, monochromators and detectors), background emission, interferences, qualitative applications in pharmaceutical analysis.


10. IR spectrophotometry- Theory, characteristics, absorption bands of organic functional group, interpretation of IR absorption spectra, frequency range, band width, and scan speed, concentration range and absorbance value, preparation of samples, sample cell, IR instrumentation (light source, monochromator detectors) qualitative and quantitative application in pharmaceutical analysis, analytical shortcomings.

11. X Ray-spectrometry - An introduction to the theory of X ray spectroscopy [miller, space lattice and unit cell, bravais lattices]. Interplaner spacing in crystal system. Diffraction of X-ray by crystal, braegg
equation, powder method, x-ray diffraction pattern of cubic system [NaCl], application on pharmaceutical analysis.

12. Nuclear magnetic resonance spectroscopy- An introduction to theory of NMR, magnetic properties of the nuclei, nuclear magnetic movements, absorption of energy, chemical shifts, shielding and deshielding, spin-2 coupling, NMR instrumentation, typical spectra, analytical applications in pharmaceutical analysis.

13. Mass spectrometry- Instrumentation, basic principles determination of molecular formula, recognition of molecular ion peak, fragmentation, mass spectra of simple compounds [saturated hydrocarbon].


15. Polarography and its application- Theory, mass transport processes, current potential relationship, polarization, choice of electrodes, instrumentation, effect of oxygen, calculation of concentration, laboratory design and safety


BOOKS RECOMMENDED
1) Svehla, G. Vogel’s Text Book of Micro and Semi Micro Qualitative Inorganic Analysis, Orient Longman, Hyderabad.


5) Higuchi, J. and Hansen E.B., Pharmaceutical Analysis, Interscience Publisher, John Willey and Sons, New York, Sydney.


7) Willard, Merritt and Settle, Instrumental Methods of Chemical Analysis, CBS Publisher and Distributors, New Delhi.

8) Ewing, G.W., Instrumental Methods of Chemical Analysis.
B.PHARM. VII SEMESTER (Theory & Tutorials)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7103</td>
<td>Pharmacology-III</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

**Hours Per Week**

**Pharmacology-III**

**Theory: 3h/week**

1. Drugs acting on the Gastrointestinal Tract
   a) Antacids, antisecretory and anti-ulcers drugs
   b) Laxatives and antidiarrhoeal drugs
   c) Appetite stimulants and suppressants
   d) Emetics and anti-emetics

2. Pharmacology of Endocrine system.
   a) Hypothalamic and pituitary hormones.
   b) Thyroid hormones and anti thyroid drugs, parathormone, calcitonin and vitamin D.
   c) Insulin, oral hypoglycaemic agents and glucagon.
   d) ACTH and corticosteroids.
   e) Androgens and anabolic steroids.
   f) Estrogen, progesterone and oral contraceptive.
   g) Drugs acting on the uterus.

3. Chemotherapy
   a) General principles of chemotherapy.
   b) Sulfonamides and cotrimoxazole.
   c) Antibiotics – Penicillins, Cephalosporins, Chloramphenicol, Erythromycin, Quinolones and miscellaneous antibiotics.
   d) Chemotherapy of tuberculosis, leprosy, fungal diseases, urinary tract infections and sexually transmitted diseases.
   e) Chemotherapy of malignancy and immunosuppressive agents.
   f) Definition of poison, general principles of treatment of poisoning with particular reference to barbiturates, opioids, organophosphorous and atropine poisoning.
   g) Heavy metals and heavy metal antagonists.
BOOKS RECOMMENDED

2) Best and Taylor's Physiological Basis of Medical Practice, William & Wilkins, Baltimore.
5) Goodman and Gilman's, The Pharmacological basis of Therapeutics; Editors: J G Hardman, L E.
8) Paul L., Principles of Pharmacology, Chapman and Hall.
B.PHARM. VII SEMESTER (Theory & Tutorials)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Name</th>
<th>L*</th>
<th>T*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>PHSC 7104</td>
<td>Drug Legislation and Regulatory Affairs</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**DRUG LEGISLATION AND REGULATORY AFFAIRS**

**Theory: 4h/week**

1. Historical background
   a) Drug legislation in India.
   b) Code of pharmaceutical ethics.

2. Drug Laws: Study of the following (with latest amendments, wherever applicable)
   a) Pharmacy Act, 1948.
   b) Drugs and Cosmetics Act, 1940 and Rules.
   c) Medicinal and Toilet Preparations (Excise Duties Act, 1955).
   d) Narcotic Drugs and Psychotropic Substances Act, 1985 and Rules.
   e) Drug (Prices Control) Order.
   f) Drugs and Magic Remedies (Objectionable Advertisements) Act 1954 and Rules.
   g) Poisons Act.
   h) Factories Act.

3. Introduction to IPR
   a) Patent Act and Rules
   b) Designs Act
   c) Trade and Merchandise Marks Act

**BOOKS RECOMMENDED**

1) N. K. Jain: Textbook of Forensic Pharmacy
2) Latest Editions of I.P., U.S.P and B.P.
3) Garfeild, Quality Assurance Principles of Analytical Laboratories
5) Bharati H K, Drugs and Pharmacy Laws in India, Sadhana Mandir, Indore.
B.PHARM. VII SEMESTER (Theory & Tutorials)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>L*</th>
<th>T*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSE 7105</td>
<td>Clinical &amp; Hospital Pharmacy</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Clinical & Hospital Pharmacy

Theory: 4h/week

3. Drug Store Management and Inventory Control:
4. Organization of drug store, Types of materials stocked, storage conditions.
5. Purchase and Inventory Control principles, purchase procedures, Purchase order, Procurement and stocking.
6. Drug distribution Systems in Hospitals:
9. Dispensing of drugs to ambulatory patients.
10. Dispensing of controlled drugs.
11. Central Sterile Supply Unit and their Management: Types of materials for sterilization, Packing of materials prior to sterilization, sterilization equipments, Supply of sterile materials.
13. Drug Information Services: Sources' of Information on drugs, disease, treatment schedules, procurement of information, Computerized services (e.g., MEDLINE), Retrieval of information, Medication error.
14. Records and Reports: Prescription filling, drug profile, patient medication profile, cases on drug interaction and adverse reactions, idiosyncratic cases etc.
15. Introduction to clinical pharmacy practice, Definition and scope, common daily terminology used in the practice of medicine.
16. Functioning and working of clinical pharmacy unit, manpower requirements.
17. Methodology and techniques of analysis of drug content and their metabolites blood and other biological fluids and to correlates the therapeutics efficacy with drug concentrate in biological fluids.
18. Biological half lifes, pKa values, pH partition coefficient, stability with reference to clinical application.
19. Pharmacists and patient counseling including specific examples.

**BOOKS RECOMMENDED**

1) Laurence, D R and Bennet P. N., Clinical Pharmacology, Churchill Livingstone.
2) Herfindal E T and Hirschman J L., Clinical Pharmacy and Therapeutics. Williams and Wilkins.
3) Remington’s Pharmaceutical Sciences.
4) W.E Hassan: Hospital Pharmacy.
5) Heifindal et al: Clinical Pharmacy & Therapeutics.
6) Allwood and Fell: Hospital Pharmacy.
### B.PHARM. VII SEMESTER (Practicals)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>P*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7106</td>
<td>Medicinal Chemistry III</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Medicinal Chemistry III**

**Practical: 3h/week**

1. Introduction to the use of stereo-models
2. Synthesis of selected drugs and prodrugs from the course content
3. Workshop on molecular modeling including QSAR
4. An exercise involving stereo-selective synthesis of a compound

**BOOKS RECOMMENDED**

3) Pharmacopoeia of India, Govt. of India, Ministry of Health, Delhi.
B.PHARM. VII SEMESTER (Practicals)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>P*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7107</td>
<td>Pharmaceutical Analysis III</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Pharmaceutical Analysis III**

**Practical: 3h/week**

1. Quantitative estimation of various drugs by UV-Visible spectrophotometer
2. Determination of the drug content in tablet formulations
3. Practicals involving flame photometer and spectrofluorometer.
4. Interpretation of IR spectra.

**BOOKS RECOMMENDED**

1) Pharmacopoeia of India, Govt. of India, Ministry of Health, Delhi.
2) Vogel’s Text Book of Micro and Semi Micro Qualitative Inorganic Analysis, Orient Longman, Hyderabad.
B. PHARM. VII SEMESTER (Practicals)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>P*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 7108</td>
<td>Pharmacology III</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

**Pharmacology III**

**Practical: 3h/week**

1. Experiments on isolated preparations: To estimate the strength of the test sample of agonist/ drug (e.g. acetylcholine, histamine, 5-HT, oxytocin, etc.) using a suitable isolated muscle preparation employing matching bioassay, bracketing assay, three point assay and four point assay.

2. Pharmacology of Gastrointestinal Tract: To study the anti-ulcer and anti-secretary activity using pylorus ligated rats.

**BOOKS RECOMMENDED**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>P*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSE 7109</td>
<td>Clinical &amp; Hospital Pharmacy</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Clinical & Hospital Pharmacy**

**Practical: 3h/week**

1. Experiments based on sterilization of various types of materials used in Hospitals.
2. Practicals designed on the use of computers in Drug Information Centre, prescription filling, documentation of information on drug interaction.

**BOOKS RECOMMENDED**

1) Laurence, D R and Bennet P. N., Clinical Pharmacology, Churchill Livingstone.
2) Herfindal E T and Hirschman J L., Clinical Pharmacy and Therapeutics. Williams and Wilkins.
3) Remington’s Pharmaceutical Sciences.
4) W.E Hassan: Hospital Pharmacy.
5) Heifindal et al: Clinical Pharmacy & Therapeutics.
6) Allwood and Fell: Hospital Pharmacy.
B.PHARM. VIII SEMESTER (Theory & Tutorials)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>L*</th>
<th>T*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 8101</td>
<td>Novel and Controlled Drug</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Delivery Systems</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Novel and Controlled Drug Delivery Systems**

**Theory: 4h/week**

1) Concepts and systems designed for rate controlled drug delivery. Mechanism of the drug release from matrix systems and reservoir systems.

2) Concept of drug targeting

3) Sustained and Controlled Drug Delivery: Design and development, physico-chemical, biological and pharmacokinetic properties influencing design and performance of controlled release products, materials and methods used in their formulation, dose designing, In vitro and In vivo evaluation.

4) Micro-encapsulation: Types of microcapsules, importance of micro-encapsulation in pharmacy, micro-encapsulation by phase separation, co-acervation, multi orifice, spray drying, spray congealing, polymerization, complex emulsion, air suspension technique, coating pan and other techniques, evaluation of micro capsules.

5) Transdermal drug delivery systems: types, design and fabrication.

6) Carrier/ vesicular based drug delivery systems i.e. Liposomes, niosomes, elastosomes, pharmacosomes.

7) General consideration and application of following drug delivery systems:
   a) Bioadhesive and mucoadhesive drug delivery.
   b) Nanopulmonary drug delivery.
   c) Occular drug delivery.
   d) Pro-drug.

**BOOKS RECOMMENDED**

9. Review articles published in various journals.
B.PHARM. VIII SEMESTER (Theory & Tutorials)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>L*</th>
<th>T*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 8102</td>
<td>Biopharmaceutics &amp; Pharmacokinetics</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**Biopharmaceutics & Pharmacokinetics**

**Theory: 4h/week**

1) Introduction to biopharmaceutics & pharmacokinetics and their role in formulation development and clinical setting. Distribution, metabolism and elimination of drugs, Biopharmaceutical study of drugs, blood level concentration, biological half life and elimination rate constant. Apparent volume of distribution.


3) Drug disposition: Distribution in blood, plasma -protein binding, application of drug protein binding.


5) Compartment Models: Definition, basis of classification, model selection criteria.

6) One-compartment open model with first order elimination kinetics, pharmacokinetics of single dose administration as applied to intravenous (rapid/bolus) and oral administration, Intravenous transfusion, superposition principle and multiple intravenous and oral administration, pharmacokinetic basis of sustained release formulations.

7) Two compartment open model with first order elimination kinetics, pharmacokinetics of single and multiple dose administration, as applied to intravenous (rapid/bolus) and oral administration intravenous infusion, pharmacokinetic basis of sustained release formulations.


9) Dosage regimen: Dosage regimen adjustment in patients with and without renal failure.

10) Non-Compartmental Analysis: Statistical moments, Application, bioavailability determination.

11) Non-Linear Pharmacokinetics: Michaelis-Menten's kinetics, pharmacokinetic characteristics, In-vivo estimation of Km and Vm, Unit impulse response. Application in bioavailability determination.

**BOOKS RECOMMENDED**


Disclaimer: This information is uploaded on website (as on date) for immediate reference only. Please crosscheck and verify with the duly signed hard copy available with the concerned departmental office / library to be aware about any upgradation or correction in the syllabus / scheme taken place time to time, as and when needed.
B.PHARM. VIII SEMESTER (Theory & Tutorials)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>L*</th>
<th>T*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 8103</td>
<td>Pharmacognosy and Phytochemistry -IV</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

Pharmacognosy and Phytochemistry -IV

Theory: 3h/week

(1) Study of indigenous traditional and emerging drugs with their source (including alternative/controversial) medicinal uses, pharmacological action/activity, chemical profile and authentication of following:

- Amla (*Phyllanthus emblica*)
- Harad (*Myrobalan-Treminalia chebula*)
- Baheda (*Terminalia bellerca*)
- Guduchi (*Tinospora cardifolia*)
- Kalmegh (*Andrographis paniculata*)
- Guggal (*Commiphora weightii*)
- Salai (*boswellia serrata*)
- Brahmi (*Centell asiatica*)
- Shankhpuspi (*Convolvulus microphyllus*)
- Bach (*Acorus calamus*)
- Kantkari (*Solanum xanthocarpum*)
- Valerian (*Valerian wallchi*)
- Jatamansi (*Nardostacys jatamansi*)
- Gokhru (*Tribulus terrestris*)
- Arjuna (*Terminalia arjuna*)
- Ashok – (Saraca indica)
- Vidang (*Embelia ribes*)
- Lahsun (*Garlic-Allium sativum*)
- Malkangni (*Celastrus paniculata*)
- Bhirava (*Semecarpus anacadium*)
- Chirayata (*Swertia chirata*)
- Neem (*Azadirachta indica*)
- Satavar (*Asparagus racemosus*)
- Safed Musli (*Chlorophytum borivalianum*)
- Artemisia (*Artemica spp*)
- Thylophora (*Thyrophia indica*)
- Morinda (*Morinda citrifolia*)
- Chitrak (*Plumbago zeylanicum*)
- Haldi (*Curcuma domestica*)
- Tephrosia (*Tephrosia purpura*)
- Bhui Amla (*Phyllanthus amarus*)
- Shiilajeet

(2) Introduction to dosage forms in Indian system of medicine with preparation and standardization of some important dosage forms such as Asavas Arishtas, Avalehas and Churnas.

(3) General method of extraction, isolation, identification and characterization of Phytoconstituents of Carbohydrates, Alkaloids Glycosides and Phenolic and Steroidal groups.

(4) An introduction to Tissue culture techniques with their scope as alternative source of Phyto-Pharmaceuticals.

(5) An overview of plants as source of Bitters, Sweeteners, Colours, Flavoures, Carotinoids, Photosenstizing agents and Vaccines

BOOKS RECOMMENDED

1. Trease, G.E. and Evans, W.C., Pharmacognosy, Bailliere Tindall, Eastbourne, U.K.
5. Indian Pharmacopoeia, Ministry of Health and Family Welfare, Govt. of India, New Delhi.
B.PHARM. VIII SEMESTER (Theory & Tutorials)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>L*</th>
<th>T*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 8104</td>
<td>Elective</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Theory: 4h/week

List of Elective Subjects:

I. GMP, Quality Assurance and Validation
II. Packaging Technology
III. Drug Design
IV. Drug Interaction
V. Nutraceuticals
VI. Herbal Drug Technology

I. GMP, Quality Assurance and Validation

2. Premises, location design, plant layout, construction, maintenance of sterile areas, control of contamination.
3. Equipment selection.
4. Raw material purchase specification.
5. In process quality controls.

II. Packaging Technology

1. Glass containers for pharmaceuticals: Glass types, their manufacture, chemical performance, testing and quality control.
2. Plastic containers for pharmaceuticals: Classification of plastic, plastic polymers and their physicochemical, mechanical and biological properties; Additives and fabrication processes. Plastic containers for parenterals and transfusion sterile drip kits, quality control testing, biological toxicity.
5. Caps and closures: Types of caps, closure, liners, child resistant caps. Elastomeris closures for parenterals, classification of elastomers, physical, chemical and biological properties and their quality control.
8. Corrugated and solid fiber boards and boxes: Types of corrugation methods.
10. Packaging machinery including strip packaging, form, fill and seal machines, liquid and solid filling machines, capping machines.
12. Tamper evident packaging systems.

III. Drug Design

1. 2-D QSAR
   a) Traditional method of drug design
   b) Physicochemical properties of compounds – Lipophilic, Electrophilic and steric. Their role in drug action.
   c) Physicochemical parameters – partition coefficient, chromatographic parameters. pKa values, chemical shift values, molar refractivity, Van der Waals radii, molecular connectivity, simple valence and calculation thereof.
   d) Substituent constants their significance and uses, correlation charts, spread over activity.
   f) Multiple regression Analysis, cross correlation.

2. 3-D QSAR
   a) Drawbacks of 2-D QSAR and need for 3-D QSAR, sources of hits, combitorial libraries, selection of a lead, optimization of a lead, drug targets.
   b) X-ray crystallography, NMR and drug design, homologous modeling.
   c) Thermodynamic consideration of drug binding – free energy change, enthalpy change, electrostatic interaction, ionic bond, charge – dipole & dipole, dipole interactions, dispersion forces.
   d) Entropic contributions – translational and rotational entropy, hydrophobic effect, salvation effects.
   e) Intermolecular interaction –free energy perturbation and partitioning method.
   f) Ligand – receptor interaction- intrinsic binding energies.
   g) Role of stereochemistry in drug design.
   h) Structure based drug design and Pharmacophore based drug design.
   i) Softwares of drug design.
IV. Drug Interactions
1. Definition and basis of drug interactions
2. Mechanism of drug interactions
3. Factors contributing to the occurrence of drug interactions
4. Drug-drug Interactions with reference to analgesics, anti-inflammatory drugs, diuretics, cardiovascular drugs, gastro-intestinal agents, antibiotics, vitamins and hypoglycemic drugs.
5. Use of drug interactions information
   a. Food and drug interactions
   b. Nicotine and drug interactions
   c. Alcohol and drug interactions
6. Adverse drug reactions
7. Patients variables
8. Legal aspects- drug interactions litigation

V. Nutraceuticals
1. Introduction to Nutraceuticals as Science: Historical perspective, classification, scope. Applied aspects of the Nutraceutical Science. Sources of Nutraceuticals. Relation of Nutraceutical Science with other Sciences: Medicine, Human physiology, genetics, food technology, chemistry and nutrition.
2. Properties, structure and functions of various Nutraceuticals: Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine alpha ketoglutarate. Use of proanthocyanidins, grape products, flaxseed oil as Nutraceuticals.
3. Current global trends in nutraceuticals, their types, raw materials, quality control and assurance, regulatory affairs and commerce in nutraceuticals.
5. New technologies in development of Nutraceuticals and functional foods and chemoprevention and Nutraceuticals.

VI. Herbal Drug Technology
1. Chemical and spectral approaches to simple molecules of natural origin.
2. Concepts of stereoisomerism taking examples of natural products.
3. Chemistry, biogenesis and pharmacological activity of medicinally important monoterpenes, sesquiterpenes, diterpenes and triterpenoids.
5. Glycosides: Chemistry and biogenesis of digitoxin, digoxin, hecogenin, sennosides and diosgenin.
7. Chemistry and biogenesis of medicinally important lignans and quassanoids, flavonoids.
8. Natural allergens, photosensitizing agents and fungal toxins.
9. An introduction to plant vaccines, plant bitters and sweeteners.
B.PHARM. VIII SEMESTER (Practicals)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>P*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 8105</td>
<td>Novel and Controlled Drug Delivery Systems</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Novel and Controlled Drug Delivery Systems**

**Practical: 3h/week**

Practicals related to theory.

**BOOKS RECOMMENDED**

6) Goldberg: Targeted Drugs.
7) Bruck, S.D., Controlled Drug Delivery, Vol. I & II.
B.PHARM. VIII SEMESTER

BIOPHARMACEUTICS & PHARMACOKINETICS (Practicals)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>P*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 8106</td>
<td>Biopharmaceutics &amp; Pharmacokinetics</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Biopharmaceutics & Pharmacokinetics**

Practical: 3h/week

Practicals based on ADME process, bioavailability, bioequivalence, protein binding, compartment models, Non-linear pharmacokinetic analysis.

**BOOKS RECOMMENDED**

B.PHARM. VIII SEMESTER (Practicals)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>P*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 8107</td>
<td>Pharmacognosy and Phytochemistry -IV</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**Pharmacognosy and Phytochemistry -IV**

**Practical: 3h/week**

1. Identification of drugs mentioned in theory (PHSC-8103) with microscopy of underlined drugs in entire and powdered form.
2. Chemical evaluations of following through extractive values: Harad, Baheda, Amla, Kalmegh and Bach
3. Chromatographic evaluations of following: Harad, Baheda, Guduchi, Amla, Kalmegh, Guggul
4. Pharmacognostic study of at least one commonly marketed herbal product
5. Excursion of Medicinal Plant Garden

**BOOKS RECOMMENDED**

2. Text Book of Pharmacognosy – T. E. Wallis
3. Pharmacognosy – Trease & Evans
4. Pharmacognosy – Brady & Taylor

B.PHARM. VIII SEMESTER (Project on elective)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>P*</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHSC 8108</td>
<td>Project on elective</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>