Vikram University, Ujjain

Syllabus

B.Sc.
(Pharmaceutical Chemistry)

COURSE MODULE
PHARMACEUTICAL CHEMISTRY

B.Sc. Semester I

Paper: Organic Pharmaceutical Chemistry **Max. Marks 70***

* Each unit carries 14 Marks

Unit I

A. Historical development of Pharmaceutical chemistry. Pharmacy and Pharmaceutical chemistry as a career. Codes of pharmaceutical ethics. Important aspects of Pharmaceutical chemistry.

B. (I) Pharmacopoeia, its history and Monograph.
(II) Classification of drugs on the basis of chemical structure and therapeutic action (at least one example of each class).

Unit II

A. Source and uses of natural drug products:
(a) Biological sources of drugs (plants, animals and microbes).
(b) Geographical sources of drugs.
(c) Marine sources of drugs.
(d) Mineral sources of drugs.

B. Theories of drug action
(a) Biological defenses.
(b) Chemical defenses.
(c) Surface-active agents.
(d) Metabolic antagonism.
(e) Enzyme neutralizers
(f) Absorption of drugs.

Unit III

A. (a) Routes of drug administration.
(b) Nature of drug receptors.
(c) Isolation of drug receptors.
(d) Modification of drug receptors.
(e) Receptors theories.

B. Different types of medicinal systems: Ayurvadic, Unani, Siddha, Homeopathic, Allopathic and other systems.

C. Liquid Solutions: Aromatic waters, Lotions, crude extracts such as Tincture and infusions.

Unit IV

A. System of weights and measures in pharmacy. Dilution and concentration of formulation, calculation by allegation, Calculation of pharmaceutical dosage.

B. Types of organic reactions, reactive intermediates (carbocation, carbanion and free radicals).

Unit V

A. Hybridizations (sp, sp^2 & sp^3), resonance, hyper conjugation, inductive and field effects, hydrogen bonding.

B. Mechanism of organic reactions: Curved arrow notations, drawing electron movement with arrows, half headed and double headed arrow, homolytic and heterolytic bond breaking. Electrophiles, Nucleophiles.

C. Isomerism, types of isomerism, optical isomerism, enantionmers, disteroisomers, mesocompounds, Geometrical isomerism.

Practicals – Pharmaceutical Chemistry

B.Sc. Semester I

Max. Marks 50

1. Preparation of Pharmaceutical Compounds:* 12 Marks
   (a) Acetanilide.
   (b) Aromatic water.
   (c) Lotion.
   (d) Aspirin.
   *(Any one to be given in the examination)
2. Determination of Iodine value of fats and oils. 12 Marks
   (a) Hydroxyl values of alcoholic substances.
   (b) Acid Value.
   (c) Saponification Value.
   *(Any one to be given in the examination)

3. Identification of elements & groups present in organic compounds. 06 Marks
   * (Any two to be given in the examination.)
4. Experimental Techniques. 06 Marks
   A. Calibration of Thermometer.
   B. Purification of pharmaceuticals Compounds
   By decolourization, recrystalization and sublimation.
   (Any one to be given in the examination.)

5. Viva-voce. 08 Marks
6. Practical Record. 06 Marks

Books recommended:

1. G. R. Chatwal: Pharmaceutical Chemistry Inorganic, Vol. I
2. G. R. Chatwal: Pharmaceutical Chemistry Inorganic, Vol. II
3. Pontley's Davis: Text Book of Pharnaceuticals.
4. Allpart: Chemistry and Pharmacy of Vegetable Drug.
5. Abraham Cantrew and Bernard Sehep : Biochemistry
6. Dr. J.L Jain: Fundamentals of Biochemistry
7. Dr.H.S.Srivastawa: Elements of Biochemistry
8. Dr. M.C. Pant : Essentials of Biochemistry
9. B.S. Bahl and G.D. Tuli : Physical Chemistry

COURSE MODULE
PHARMACEUTICAL CHEMISTRY

B.Sc. Semester II

Paper: Inorganic and Physical Pharmaceutical Chemistry **Max. Marks 70***

* Each unit carries 14Marks

Unit I

Impurities in Pharmaceutical substance and their tests:

(a) Sources of impurities in pharmaceutical chemicals.
(b) Effects of impurities.
(c) Permissible impurities in pharmaceutical substances.
(a) Methods used to purify inorganic substances.
(b) Tests of purity.
(c) Limit tests.

Unit II

Volumetric estimation:

(a) Introduction of volumetric estimation and its advantages.
(b) Method of expressing concentration in volumetric analysis and numerical based on it.

Types of Titration methods:

(a) Acid –Base titrations.
(b) Oxidation-Reduction titrations.
(d) Complexometric titrations.

Unit III

B. Preparation of the following compounds and their uses:

(a) Alum.
(b) Aluminium hydroxide gel.
(c) Antimony potassium tartarate.
(d) Aromatic spirit of ammonia.
(e) Boric acid.
(f) Potassium citrate.
(g) Sodium benzoate.
(h) Milk of Magnesia.
(i) Magnesium carbonate.
(j) Zinc oxide.

Unit IV

Pharamacokinetics

Introduction including clinical pharmacokinetics, toxicokinetics and clinical toxicology, therapeutic concentration range, doses regimen, plasma drug concentration.

Unit V

Pharmacokinetic and pharmacodynamic parameters including peak plasma concentration, time of peak concentration, area under the curve, minimum effective concentration, maximum safe concentration, fraction of the drug absorbed, rate, rate constants and order of reaction- zero order kinetics, first order kinetics and mixed order kinetics.

Practicals – Pharmaceutical Chemistry

B.Sc. Semester II

Max. Marks 50

1. Preparation of Pharmaceutical Compounds: (Any one to be given in the examination) 10 marks
   (a) Tincture iodine.
   (b) Chrome alum
   (b) Ferrous ammonium sulphate.
   (c) Antimony potassium tartarate.
   (d) Alum.

2. Volumetric estimation: (Any one to be given in the examination) 10 marks

   (a) Assay of Borax.
   (b) Assay of Zinc oxide.
   (c) Assay of Sodium carbonate.

3. Volumetric estimation of Ferrous sulphate using 10 marks
   (i) Oxalic acid
   (ii) KMnO4
   (iii) $K_2Cr_2O_7$

4. Preparation of Standard Solutions. 06marks

4. Viva 08 marks
5. Practical Record. 06 marks

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3. Pontley's Davis: Text Book of Pharmaceuticals.
4. Allpart: Chemistry and Pharmacy of Vegetable Drug.
5. Abraham Cantrew and Bernard Sehep: Biochemistry
6. Dr. J.L Jain: Fundamentals of Biochemistry
7. Dr.H.S.Srivastawa: Elements of Biochemistry
8. Dr. M.C. Pant: Essentials of Biochemistry
9. B.S. Bahl and G.D. Tuli: Physical Chemistry

COURSE MODULE
PHARMACEUTICAL CHEMISTRY

B.Sc. Semester-III
Paper: Medicinal Chemistry, Natural Products

Unit I

General Anesthetics: General Discussion Classification and synthesis of Nitrous Oxide, Chloroform, Halothane, Thiopental Sodium.

Local Anesthetics: General Discussion Classification and synthesis of Procaine Hydrochloride, Benzocaine, Lignocaine hydrochloride

Unit II

Hypnotics and Sedatives: Classification, Structural Activity Relationship (SAR) and synthesis of Barbiturates, Allobarbital, hexobarbital

Tranquillizers: Classification, Mode of action and Synthesis of Reserpine, Chloropromazine Hydrochloride and Diazepam.

Anticonvulsants: Classification and Synthesis of Phenobarbital, Phenytoin Sodium.

Unit III

Analgesic and Antipyretics: General Discussion, Classification of Analgesics & Antipyretics, Mode of action and SAR of Morphine & its Analogues, Mefenamic acid, Ibuprofen, Paracetamol & Aspirin.

Antihistaminics: General Discussion, Mode of action, SAR of Ethanolamine derivatives and synthesis of Diphenhydramine Hydrochloride, Mepyramine, Promethazine Hydrochloride.

Unit IV

Carbohydrates: Classification, General discussion on Monosaccharides, Disaccharides, & Polysaccharides. Glucose, Configuration of Aldoses, Cyclic structure of D-Glucose, Mutarotation and Conformation.

Glycosides: Classification, B-D- methyl glycosides, structure of Anthraquinone Glycosides, Cardiac Glycosides, and Tannins.

Unit V

Amino acids: Classification, Properties and Method of Synthesis of amino acids, Nucleoproteins, Nucleic Acid, Nucleosides, Nucleotides.

Proteins: Isolation and Classification of Protein, Hydrolysis of Proteins. Fibrous and Globular Proteins.

Heterocyclic Compounds: Nomenclature, Structure and reaction of Oxazoles, Indole, Isoquinoline.

Books recommended:

1. Delgado JN, Remers WA eds " Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
2. Foye WO " Principles of Medicinal chemistry ' Lea & Febiger.
3. Hetrocyclic Chemistry- R.K. Bansal, New Age Publication.
4. Medicinal Chemistry- Ashutosh kar, New Age Publication.
5. Medical Pharmacology- K D Tripathi, JPS Publication.
6. Pharmacognosy- C. K. Kokate, Vallabh Prakashan.
7. Organic chemistry of natural products- G. R. Chatwal.
8. Medicinal chemistry- by Yogesh and Maheshwari.

Practical - Pharmaceutical Chemistry
B.Sc. Semester-III

Max. Marks 50

1. Limit Tests i. Chloride ii. Sulphate	**06**
2. Estimation of i. Ammonium Chloride ii. Zinc sulphate iii. Citric acid	**10**
3. Identification of the Tablets i. Aspirin ii. Paracetamol iii. Analgin iv. Diazipam	**06**
4. Identification of natural products through Chromatography (TLC / PC). i. Amino acids ii. Carbohydrate iii. Pigments	**06**
5. Preparation of i. N-phenyl azo β naphthol. ii. Diphenyl thiourea	**08**
6. Vivo-voce.	**08**
7. Practical Record.	**06**

COURSE MODULE
PHARMACEUTICAL CHEMISTRY

B.Sc. Semester-IV

Paper: Medicinal Chemistry, Natural Products and Instrumentation

Unit I

Diuretics: Classification of Diuretics, Structure, Synthesis and uses of Hydrochlorothiazide, Hydroflumethiazide, Ethacrynic Acid, Furosemide, Acetazolamide, Spironolactone, Chlorthalidone.

Antihypertensives: Classification of Antihypertensive agents and Synthesis of Captopril, Propranalol Hydrochloride, Methyl DOPA, Guanithidine .

Unit II

Adrenergic Agents: Classification and SAR of Phenyl ethylamine analogues, Synthesis of adrenaline, Epinephrine(Adrenaline), Norepinephrine (Noradrenaline), Ephedrine, Dopamine.

Anticoagulants: Classification of anticoagulants and synthesis, uses and Mode of action of Heparin, Dicoumarol, Warfarin.

Unit III

Expectorants and Antitussives: Classification of Expectorants and synthesis of Acetylcysteine, Guaifensin, Noscapine.

Muscle Relaxants: Classification and general mechanism of action of Muscle Relaxants and Synthesis of Suxamethonium chloride, Dacamethonium bromide.

Unit IV

Terpenes: Isolation, classification, general method of determining structure with reference to Citral, Menthol, Camphor (without synthesis).

Alkaloids: General method of determining structure of alkaloids, Classification, a general study of structure of Quinine, Morphine, Atropine (without synthesis).

Unit V

Lipids: Fats, Oils, Waxes, Fatty Acids, Physico-chemical properties, Phospholipids, Lecithines, Cephalins, Glycolipids.

Steroids: Isolation, Nomenclature and general study of structure of Cholesterol, Stigmasterol and Cortisone.

Books recommended:

1. Delgado JN, Remers WA eds " Wilson & Gisvolds's Text Book of Organic Medicinal & Pharmaceutical Chemistry" Lippincott, New York.
2. Foye WO " Principles of Medicinal chemistry ' Lea & Febiger.
3. Hetrocyclic Chemistry- R.K. Bansal, New Age Publication.
4. Medicinal Chemistry- Ashutosh kar, New Age Publication.
5. Medical Pharmacology- K D Tripathi, JPS Publication.

Practical - Pharmaceutical Chemistry

B.Sc. Semester-IV

Max. Marks 50

1. Limit Tests (Any one to be given in the examination) **06**

i. Nitrate
ii. Iron

2.Estimation of (Any one to be given in the examination) **10**

i. Benzoic acid
ii. Glycine
iii. Hardness of water

3. Systematic identification of organic compounds.

5. Preparation of (Any one to be given in the examination) **08**

(a) Methyl orange
(b) Phenolphthalein
(c) Urotropin

Isolation of

(a) Caffeine from tea leaves.
(b) Casein from milk

6. Vivo-voce. **08**

7. Practical Record. **06**

COURSE MODULE
PHARMACEUTICAL CHEMISTRY
B.Sc. Semester-V

Unit I

Optical Isomerism- R-S nomenclature.

Conformational Analysis: conformational analysis of ethane, butane, cyclohexane, study of Fischer, Newman and Sawhorse projections.

Organic Reactions: Introduction and elementary idea of Substitution (SN1, SN2) Addition (addition of Br_2 and HBr to Symmetrical and unsymmetrical alkenes) and Elimination (E1, E2)

Unit II

Drug Designing- A general study of the physic- chemical properties in relation to biological activities. Stereochemistry and drug action. Isosterism and Bioisosterism Metabolic changes of drugs and related of organic compounds in the body.

Unit III

Spectroscopic Methods: Principle, instrumentation and application of Ultraviolet spectroscopy & Infrared spectroscopy.

Unit IV

Antimalarials: Classification, structure, synthesis, mode of action and uses of chloroquine phosphate, amodiaquine hydrochloride, primaquine phosphate SAR of Antimalarials.

Gastro–intestinal drugs: - antacids, digestants, emetics & anti emetics.

UNIT V

Fundamentals of Potentiometer, Potentiometer Titrations, Conduct metric measurements- Ohms law, Conductance, Specific resistance, Specific conductance, Molecular conductance, Equivalent conductance, their relationship, determination of cell constant, applications of conductometry & potentiometry.

Polarography- Introduction, apparatus, factors affecting the limiting current and its applications.

COURSE MODULE
PHARMACEUTICAL CHEMISTRY

Practical - B.Sc. Semester-V

Maximum Marks --50

1. Systematic separation and identification of organic binary mixture.	12 Marks
2. (A) Interpretation of given UV and IR Spectra.	4 Marks
(B) Chromatographic Identification of given Compounds/ ions through their Rf Values.	4 Marks
(C) Study of Various organic Molecules through their Models.	4 Marks
3. Disintegration studies of tablets- Weight Variation/Friability of tablets.	12 Marks
4. Viva Voice	8 Marks
5. Practical Record	6 Marks

COURSE MODULE
PHARMACEUTICAL CHEMISTRY

B.Sc. Semester-VI

Unit I

Antibiotics:

a) Introduction, classification, isolation, constitutions, synthesis and uses of penicillin and semi synthetic penicillin.

b) Study of structures and uses of streptomycin, neomycin,

c) Constitution, Synthesis and uses of chloramphenicol.

d) Tetracycline: SAR characteristics and uses.

Unit II

a) **Sulphonamides:** Mechanism of action of suphonamides, synthesis and use of sulphacetamide, suphaguianidine, Dapsone.

b) **Antitubercular drugs**: Synthesis and mode of action of PAS, INH, Isoniazid , Rifampicin.

Unit III

c) Antiamoebic drugs: Classification, synthesis, structure and uses of Metronidazole.

d) Antifungal: Synthesis and uses of ketoconazole, clotrimazole, tolnaftate, griseofulvin.

Unit IV

e) **Antidiabetic:** Structure, synthesis, uses and mode of action of Tolbutamide, Chlorpropamide. Pharmacology of diabetics

f) Antineoplastic Agents: Pharmacology of cancer, classification, synthesis, mechanism of action of 5-fluoro uracil, 6-mercapurine, Thiotepa, Busalfan.

Unit V

Nuclear Magnetic Resonance spectroscopy. Magnetic properties of nuclei, field and precession, principle, chemical shift concept, isotopic nuclei, reference standards and solvents. 1H NMR spectra, chemical shifts, multiplicity, coupling constants, integration of signals, interpretation of spectra, Instrumentation and application.

Practicals - Pharmaceutical Chemistry
B.Sc. Semester-VI

Max. Marks 50

1. Pharmaceutical preparations (Any 2 given in the examination) — 12 Marks

2. Pharmaceutical Instrumentation (Any two to be given in the examination) — 12 Marks
   (a) Determination of hardness of tablets.
   (b) Determination of disintegration time of tablets.

3. Organic synthesis (Any one to be given in the examination) — 12 Marks
   a) Benzil
   b) Thalimide
   c) Sulphanilic acid

4. Viva-voce — 08 Marks

5. Practical Record — 06 Marks