

Department of Higher Education, Govt. of M.P.

Post graduate semester wise syllabus

As recommended by Central Board of studies and approved by the governor of M. P.

उच्च शिक्षा विभाग, मध्यप्रदेश शासन

स्नातकोत्तर कक्षाओं के लिए सेमेस्टर अनुसार पाठ्यक्रम

केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म. प्र. के राज्यपाल द्वारा अनुमोदित

Session (सत्र) - 2015-16

Scheme of Marks

B. Sc. Pharmaceutical Chemistry

Paper	Comp/ Opt	Paper Title	Max. Marks
I Sem	Compulsory	Organic Pharmaceutical Chemistry	85 + 15 (CCE) = 100
		PRACTICAL	50
II Sem	Compulsory	Inorganic and Physical Pharmaceutical Chemistry	85 + 15 (CCE) = 100
		PRACTICAL	50
III Sem	Compulsory	Medicinal Chemistry, Natural Products	85 + 15 (CCE) = 100
		PRACTICAL	50
IV Sem	Compulsory	Medicinal Chemistry, Natural Products and Instrumentation	85 + 15 (CCE) = 100
		PRACTICAL	50
V Sem	Compulsory	Analytical Organic Chemistry	85 + 15 (CCE) = 100
		PRACTICAL	50
VI Sem	Compulsory	Medicinal Chemistry	85 + 15 (CCE) = 100
		PRACTICAL	50
		PROJECT	50
		TOTAL	950

Shri Suresh Arora
7/7/15

Khil 13/

COURSE MODULE
PHARMACEUTICAL CHEMISTRY
2015-16
B.Sc. Semester I

Paper: Organic Pharmaceutical Chemistry

Max. Marks 85*

* Each unit carries 17 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: Ayurvedic, 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, enantiomers, diastereoisomers, meso compounds, Geometrical isomerism.

Handwritten signature
7/7/15

Handwritten signature

Handwritten signature
Dr. Kalpana Singh

Handwritten signature
Sue Roy



PRACTICALS – PHARMACEUTICAL CHEMISTRY
2015-16
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, recrystallization 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

Sham
7/7/15 *Suk*

Arpan

Kalp
Dr. Kalpana Singh

Boj

COURSE MODULE
PHARMACEUTICAL CHEMISTRY
2015-16
B.Sc. Semester II

Paper: Inorganic and Physical Pharmaceutical Chemistry

Max. Marks 85*

* Each unit carries 17 Marks

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

Pharmacokinetics

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.

Handwritten signature
7/7/15

Handwritten signature

Handwritten signature

Handwritten signature
Dr. Kalpana Singh

Handwritten signature

PRACTICALS – PHARMACEUTICAL CHEMISTRY
2015-16
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) KMnO_4
 - (iii) $\text{K}_2\text{Cr}_2\text{O}_7$

4. Preparation of Standard Solutions. 06marks

4. Viva 08 marks
5. 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 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

Su Aram
Anam
7/7/15

~~Pat~~
Kish
Dr. Kulpala Singh

COURSE MODULE
PHARMACEUTICAL CHEMISTRY
2015-16
B.Sc. Semester-III

Paper: Medicinal Chemistry, Natural Products

* Each unit carries 17 Marks

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, Allobarbitol, hexobarbital

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

Anticonvulsants: Classification of anticonvulsant drugs and Synthesis of Phenobarbital and Phenytoin sodium.

Unit III

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

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

Unit IV

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

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

Amino acids: Classification, Properties and Method of Synthesis and properties of amino acids.

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

Unit V

Basics of Inorganic Chemistry

Shapes of orbitals, Valence bond theory, Hybridization in inorganic molecules, VSEPR basis of MOT, Calculation of bond order and MO diagram for O₂, N₂ and CO.

Books recommended:

1. Delgado JN, Remers WA eds "Wilson & Gisvold'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.
9. Inorganic Chemistry- Cotton & Wilkinson.
10. Inorganic Chemistry- J. D. Lee.
11. Selected topic in inorganic chemistry- Malic, Madan & Tuli.

Sharma
7/11/15

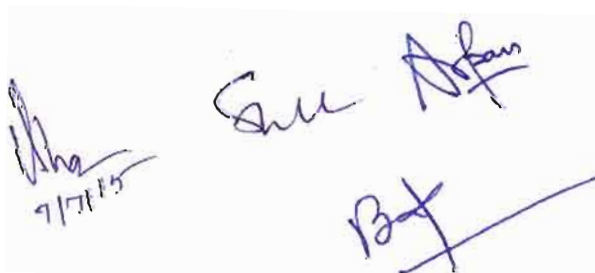
Sall *Arjun*

Pat
Vijay
Kalpna Singh
⑥

PRACTICAL - PHARMACEUTICAL CHEMISTRY
2015-16
B.Sc. Semester-III

Max. Marks 50

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



Handwritten signatures and dates: A signature with the date 9/7/15, the name Sun Arpan, and another signature.



Handwritten signature: K. Singh Dr. Kalpana Singh

COURSE MODULE
PHARMACEUTICAL CHEMISTRY
2015-16
B.Sc. Semester-IV

Paper: Medicinal Chemistry, Natural Products and Instrumentation

* Each unit carries 17 Marks

Unit I

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

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

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.

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

Unit III

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 IV

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.

Unit V

Concept of acid and Bases: Arrhenius concept, Bronsted- Lowry concept, Strength of acid and bases. Lewis concept, pH, pKa and pKb values, buffers in pharmacy

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.

Handwritten signatures and initials:
Raf
Sule
Khal
Dr. Kalpana Singh
Arfan

PRACTICAL - PHARMACEUTICAL CHEMISTRY
2015-2016
Practical -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 |


The image shows several handwritten signatures and marks. At the top center, there is a signature that appears to be 'Baf' with a horizontal line underneath. Below this, on the left, is another signature with the number '712115' written below it. In the middle, there is a signature that looks like 'Suk' followed by 'Nandan' with a horizontal line underneath. On the right, there is a signature that appears to be 'K Singh' with 'Dr. Kalpana Singh' written below it.

COURSE MODULE
PHARMACEUTICAL CHEMISTRY

2015-16

B.Sc. Semester-V

* Each unit carries 17 Marks

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 Br₂ 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.

By
7/17/15

Sule Arpan

K Singh
Dr Kalpana Singh

COURSE MODULE
PHARMACEUTICAL CHEMISTRY

2013-2014
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 |



Handwritten signatures and dates:
1. A signature with a horizontal line below it.
2. A signature with the date "7/7/15" written below it.
3. The name "Sru Arpan" written in cursive.
4. A signature with the name "Dr. Kalpana Singh" written below it.

COURSE MODULE
PHARMACEUTICAL CHEMISTRY

2015-2016
B.Sc. Semester-VI

* Each unit carries 17 Marks

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 sulphenamides, synthesis and use of sulphacetamide, sulphaguanidine, 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-mercaptopurine, Thiotepa, Busulfan.

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.

Raf *Wb*
7/7/15

Sale *Ajfan* *V. Singh*
Dr. Kalpana Singh

(12)

PRACTICALS - PHARMACEUTICAL CHEMISTRY
2015-16
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



A handwritten signature in blue ink, possibly reading 'Raf' or similar, with a horizontal line underneath.



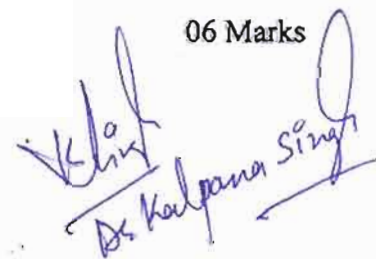
Handwritten signature in blue ink above the number '717115'.



Handwritten signature in blue ink, possibly reading 'Anam'.



Handwritten signature in blue ink, possibly reading 'Sue'.



Handwritten signature in blue ink, possibly reading 'Dr. Kalpana Singh'.