



**School of Health Sciences**  
**Ph. D Entrance Test- July 2019**

**College of Pharmaceutical Sciences**

**PART B**

**Syllabus for Ph.D. Entrance Test in Pharmaceutical Sciences**

**Note: Candidates will choose a discipline depending on their specialization in PG study and answer.**

**Discipline : Pharmaceutical Analysis**

**UNIT-1**

1. UV-Visible spectroscopy: Introduction of Electromagnetic spectrum, Theory, Laws, Instrumentation and terminology associated with UV-Visible spectroscopy, Choice of solvents and Applications of UV-Visible spectroscopy.

**UNIT-2**

2. Chromatography: Principle, Apparatus, Instrumentation, Chromatographic parameters, Endpoint determination and Applications of the following:

- a) Paper chromatography
- b) Thin Layer chromatography
- c) Column chromatography
- d) Gas chromatography
- e) High Performance Liquid chromatography
- f) High Performance Thin Layer chromatography

**UNIT-3**

3. Calibration, validation and cleaning validation for the following instruments used in pharmaceutical industry:

- a) HPLC b) HPTLC c) GC d) IR e) UV

**UNIT-4**

4. Analytical method and bio analytical method development and its validation according to ICH and USP guidelines.



## UNIT-5

Statistical Analysis – Introduction, Significance of statistical methods, normal distribution, probability, degree of freedom, standard deviation, correlation, variance, accuracy, precision, classification of errors, reliability of results, confidence interval, test for statistical significance – Students T test, F test, Chi square test, Correlation and regression.

## Discipline: Pharmaceutics

### Unit I

#### Preformulation studies

Introduction, preformulation goals, consideration of physico-chemical properties of new drug molecules for different dosage forms. Solubility: aqueous solubility, organic solubility, intrinsic solubility, methods of enhancement of solubility-surfactants, pH, co-solvency, solid dispersion and complexation.

### Unit II

#### Optimization

Optimization techniques in pharmaceutical formulation and processing - introduction, optimization parameters, statistical designs for screening and optimization of pharmaceutical formulations. QbD, elements and tools of QbD.

### Unit III

#### ADME of drugs

Definitions, Gastro-intestinal absorption of drugs, mechanisms of drug absorption, Factors affecting drug absorption: Biological, Physiological, Physicochemical, Pharmaceutical. Methods of determining absorption: *In vitro*, *in situ* and *in vivo* methods. Concepts of distribution, metabolism and elimination of drugs.

#### Bioavailability and Bioequivalence

Objectives and consideration in bio-availability studies, Concept of equivalents, Measurements of bio-availability, Determination of the rate of absorption. Bioequivalence and its importance.

### Unit IV

#### Sustained and controlled release drug delivery systems

Introduction, concept, advantages and disadvantages, rationale of sustained and controlled release drug delivery systems. Physico-chemical and biological factors to be considered for the design and development of sustained and controlled release drug delivery systems.

### Unit V

#### Targeted drug delivery systems

Concept, advantages and disadvantages of drug targeting. Development, evaluation and application of polymeric nanoparticles, solid lipid nanoparticles, liposomes, niosomes and resealed erythrocytes.



## **Discipline: Pharmacology**

### **Unit I**

Molecular Mechanisms in Cell regulation, Signaling molecules and their receptors  
Molecules: Nitric oxide, carbon monoxide, neurotransmitters, cytokines, peptide hormones, growth factors and eicosanoids.

Receptors: Cell surface Receptors: Ion channels, G-protein coupled receptors, tyrosine kinase receptors, cytokine receptors, nuclear receptors.

### **Unit II**

Pharmacotherapy of Ischaemic heart disease, CCF, Cardiac arrhythmias and Dyslipidemia, Atherosclerosis, Parkinson's disease, Alzheimer's disease, Schizophrenia, Stroke, Arteriosclerosis, Asthma and COPD, Epilepsy, Rheumatoid & Osteoarthritis, Myasthenia gravis, Inflammatory bowel diseases, Constipation and Diarrhea.

### **Unit III**

Preclinical models employed in the screening of new drugs belonging to the following categories: Antipsychotic agents, Antianxiety agents, Nootropic drugs, Antidepressant drugs, Antiparkinsonian agents, Analgesics, Antiepileptics, Antiinflammatory agents, Antiulcer agents, Antianginals and myocardial infarction, Antiarrhythmics, Antiatherosclerotic drugs, Hepatoprotectives, Antidiabetics, Antihypertensives, Anticancer agents

### **Unit IV**

Modern techniques to elucidate the mechanism of drug actions- Cell culture and maintenance: Concepts of in-vitro screening, Different cell lines (animal & human) used in screening techniques. Primary and secondary cultures, Principles of techniques involved in cell culture and its maintenance. Alternatives to animal screening procedures- cell-line, patch-clamp technique and invitro models.

### **Unit V**

Recombinant DNA Technology: Principles, process and applications. Gene cloning: Isolation, cloning vectors, enzymes used in molecular cloning, PCR (Polymerase chain reaction), LCR (Ligation chain reaction) and their applications.



## Discipline - Pharmacognosy

### Unit I

1. General methods of isolation, purification, identification and estimation of phytoconstituents (with special emphasis on HPLC & HPTLC).
2. WHO guidelines for assessment of crude drugs  
Evaluation of identity, purity and quality of crude drugs.  
Determination of pesticide residue.  
Determination of arsenic and heavy metals.  
Determination of micro-organisms

### Unit II

3. Detailed phytochemical study of following class of phytoconstituents.
  - Phospholipids
  - Terpenes and Terpenoids
  - Resins and related compounds
  - Plant phenols
  - Alkaloids
  - Glycosides
  - Steroids

### Unit III

4. Enzymes:
  - Types and properties of enzymes
  - Isolation and purification of enzymes
  - Immobilization of enzymes and its applications
  - Enzyme reactors
  - Detailed study of plant enzymes – Papain and Bromelain

### Unit IV

5. Tissue Culture:



- Type, techniques and application of callus, suspension, haploid, embryo, organ and immobilized culture.
- Organogenesis, embryogenesis, synthetic seed and somaclonal variation.
- Micropropagation
- Production of secondary metabolites – Strategies involving use of precursor, growth regulators and Elicitors: Production of Shikonin.
- Hairy root culture and Multiple shoot culture and their application.
- Protoplast culture and protoplast fusion.
- Biotransformation.

## Unit V

### 6. Patents:

Indian and International patent laws, proposed amendments as applicable to herbal/natural products and processes; important points to be kept in mind while drafting and filing a patent.

### 7. Herbal Cosmetics:

- Raw materials of herbal origin used in cosmetics: Oil, waxes, gums, hydrophilic colloids, colours, perfumes, protective agents, bleaching agents, preservatives, anti-oxidants and other ancillary agents.
- Formulation aspects incorporating herbal extracts in various preparations like Skin care creams, deodorants, anti-perspirants, hair care preparations.
- Detailed methods of preparation of few representative preparations and standardization of above categories.



## Discipline: Pharmaceutical Chemistry

### Unit I

#### 1. Basic Aspects of Organic Chemistry

- Chemical bonding: emphasizing localized, delocalized and bonding weaker than covalent bonds.
- Organic reaction intermediates: carbocations, carbanions, free radicals, carbenes and nitrenes. Their method of formation, stability and synthetic applications.
- Various types of reaction mechanism, reaction and methods of determining them.

#### 2. Detailed study of the following topics:

- Substitution reactions (aliphatic nucleophilic, aromatic electrophilic, aliphatic electrophilic, aromatic nucleophilic and free radical substitutions).
- Addition reactions (both carbon-carbon and carbon-heteroatom multiple bonds).
- Elimination reactions (E1, E2 and Hoffman Saytzeff's) and Rearrangement reactions.
- Oxidation – reduction reactions and the reagents used for such reactions.
- Protection and deprotection of various groups.

### Unit II

#### 1. A study of the following reactions of synthetic importance:

- Mannich reaction.
- Meerwein-Ponndorf-Verley (MPV) reduction.
- Oppenauer oxidation.
- Beckmann rearrangement.
- Grignard reaction.
- Hoffman rearrangement.
- Ozonolysis.
- Reformatsky reaction.
- Michael reaction.
- Birch reduction.

#### II Introduction to combinatorial chemistry

- Introduction to Combinatorial Libraries. Concepts and Terms
- Parallel Organic Synthesis Technology
- Polymer-Supported Synthesis of Organic Compounds and Libraries
- Macro Beads in Solid-Phase Synthesis
- Combinatorial Libraries in Solution.

### Unit III



**1. Quantitative structure activity relationship ( QSAR)**

- a. History and development
- b. Theoretical compartment model for relationship between physical properties and biological activity(Hammet, Taft)
- c. Hansch analysis, Free Wilson analysis, applications and relationship between them.
- d. Statistical methods like Regression analysis,PLS and other multivariate statistical methods.,3D QSAR approaches.

**2. Designing and applications of Prodrugs:**

Basic concept, Prodrugs of functional group, Prodrug design to improve Patient acceptability, Drug solubility, Drug absorption and distribution, site specific drug delivery, and sustained drug action. Rationale of prodrug design and practical consideration of prodrug design.

**Unit IV**

**1. Definition, classification, Isolation, SAR and chemistry of Natural products.**

**\* Structural elucidation**

1. Alkaloids and Cardiac Glycosides
  - a) Opium alkaloids: Morphine\*, Papavarine\*
  - b) Indole alkaloids: Reserpine\*, Emetine\*
  - c) Vinca alkaloids: Vinblastine\*, Vincristine\*
  - d) Cinchona alkaloids: Quinine\*, Quinidine
  - e) Cardiac glycosides: Digitallis, Ouabain\*
2. Steroidal Hormones
  - a) Female and male sex hormones –development of antifertility agents.
  - b) Adrenal cortex hormones and their derivatives
  - c) Development of anabolic steroids and antifertility agents

**Unit- V**

**1. Antibiotics**

- A) Penicillins and Cephalosporins-Chemistry, SAR
  - a) Early Penicillins and cephalosporins
  - b)AmidoPenicillins
  - c)Beta lactamase stable cephalosporins
  - d)Antipsuedomonalpenicillins and cephalosporins
- B) New oral compounds and future prospects of other betalactam agents
  - a) Nocardins and monobactams
  - b) Clavulanic acid analogs
  - c) Carbapenams
  - d) Other fused Betalactam systems

**2. Antineoplastic agents of Natural origin-**



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University

- a) Chemistry of Podophyllotoxin and its derivatives, taxol and artemisinin
- b) Purines and Pyrimidines as Antineoplastic agents

### 3. Marine Natural products with therapeutic potential

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