



**ROYAL COLLEGE OF PHARMACY**

**WAZIRPUR**

**DEPARTMENT OF PHARMACEUTICAL CHEMISTRY**

**Course: Diploma in Pharmacy**

**LESSON PLAN**

**Faculty Name: Mr. Saket**

**Subject: Pharmaceutical Chemistry**

**Class: D. Pharmacy – Ist Year**

**Subject Code: ER20-12T**

**Scope:**

This course is designed to impart basic knowledge on the chemical structure, storage conditions and medicinal uses of organic and inorganic chemical substances used as drugs and pharmaceuticals. Also, this course discusses the impurities, quality control aspects of chemical substances used in pharmaceuticals.

**Course Objectives:**

This course will discuss the following aspects of the chemical substances used as drugs and pharmaceuticals for various disease conditions

1. Chemical classification, chemical name, chemical structure
2. Pharmacological uses, doses, stability and storage conditions
3. Different types of formulations / dosage form available and their brand names
4. Impurity testing and basic quality control tests

**Course Outcomes:**

Upon successful completion of this course, the students will be able to

1. Describe the chemical class, structure and chemical name of the commonly used drugs and pharmaceuticals of both organic and inorganic nature
2. Discuss the pharmacological uses, dosage regimen, stability issues and storage conditions of all such chemical substances commonly used as drugs
3. Describe the quantitative and qualitative analysis, impurity testing of the chemical substances given in the official monographs
4. Identify the dosage form & the brand names of the drugs and pharmaceuticals popular in the marketplace

**Prescribed Hours: 75Hr.**

| Lecture No.                                                               | Particular                                                                                                                                                                                 | Remark / Date |
|---------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| <b>Module 1: Introduction to Pharmaceutical chemistry</b>                 |                                                                                                                                                                                            |               |
| 1.                                                                        | Introduction to Pharmaceutical chemistry: Scope and objectives                                                                                                                             |               |
| 2.                                                                        | Types of errors: Accuracy, precision, significant figures                                                                                                                                  |               |
| 3.                                                                        | Sources Impurities in Pharmaceuticals: Source and effect of impurities in pharmacopeial substances                                                                                         |               |
| 4.                                                                        | Importance of limit test, Principle and procedures of Limit tests for chlorides                                                                                                            |               |
| 5.                                                                        | Importance of limit test, Principle and procedures of Limit tests for sulphates                                                                                                            |               |
| 6.                                                                        | Importance of limit test, Principle and procedures of Limit tests for iron                                                                                                                 |               |
| 7.                                                                        | Importance of limit test, Principle and procedures of Limit tests for heavy metals                                                                                                         |               |
| 8.                                                                        | Importance of limit test, Principle and procedures of Limit tests for arsenic                                                                                                              |               |
|                                                                           | <b>CLASS TEST</b>                                                                                                                                                                          |               |
| <b>Module 2: Volumetric Analysis</b>                                      |                                                                                                                                                                                            |               |
| 9.                                                                        | Fundamentals of volumetric analysis                                                                                                                                                        |               |
| 10.                                                                       | Acid-base titration                                                                                                                                                                        |               |
| 11.                                                                       | Non-aqueous titration                                                                                                                                                                      |               |
| 12.                                                                       | Precipitation titration                                                                                                                                                                    |               |
| 13.                                                                       | Redox titration                                                                                                                                                                            |               |
| 14.                                                                       | Complexometric titration                                                                                                                                                                   |               |
| 15.                                                                       | Gravimetric analysis: Principle and method                                                                                                                                                 |               |
| 16.                                                                       | Gravimetric analysis: Principle and method                                                                                                                                                 |               |
| 17.                                                                       | Introduction of Inorganic Pharmaceuticals products                                                                                                                                         |               |
| 18.                                                                       | Pharmaceutical formulations, storage conditions and uses of                                                                                                                                |               |
|                                                                           | <b>CLASS TEST</b>                                                                                                                                                                          |               |
| <b>Module 3: Inorganic Pharmaceuticals</b>                                |                                                                                                                                                                                            |               |
| 19.                                                                       | Haematinics: Ferrous sulphate, Ferrous fumarate, Ferric ammonium citrate, Ferrous ascorbate, Carbonyl iron                                                                                 |               |
| 20.                                                                       | Gastro-intestinal Agents Antacids: Aluminium hydroxide gel, Magnesium hydroxide, Magaldrate, Sodium bicarbonate, Calcium Carbonate, Acidifying agents, Adsorbents, Protectives, Cathartics |               |
| 21.                                                                       | Topical agents: Silver Nitrate, Ionic Silver, Chlorhexidine Gluconate, Hydrogen peroxide, Boric acid, Bleaching powder, Potassium permanganate                                             |               |
| 22.                                                                       | Dental products: Calcium carbonate, Sodium fluoride, Denture cleaners, Denture adhesives, Mouth washes                                                                                     |               |
| 23.                                                                       | Medicinal gases: Carbon dioxide, nitrous oxide, oxygen                                                                                                                                     |               |
|                                                                           | <b>CLASS TEST</b>                                                                                                                                                                          |               |
| <b>Module 4: Introduction to nomenclature of organic chemical systems</b> |                                                                                                                                                                                            |               |
| 24.                                                                       | Introduction to nomenclature of organic chemical systems with particular reference to heterocyclic compounds containing up to Three rings                                                  |               |
| 25.                                                                       | Introduction to nomenclature of organic chemical systems with particular reference to heterocyclic compounds containing up to Three rings                                                  |               |
|                                                                           | <b>CLASS TEST</b>                                                                                                                                                                          |               |
| <b>Module 5: Drugs Acting on Central Nervous System</b>                   |                                                                                                                                                                                            |               |

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| 26.                                                       | Anaesthetics: Thiopental sodium, Ketamine hydrochloride , Propofol                                                                                                                 |  |
| 27.                                                       | Sedatives and Hypnotics: Diazepam, Alprazolam                                                                                                                                      |  |
| 28.                                                       | Sedatives and Hypnotics: Nitrazepam, Phenobarbital                                                                                                                                 |  |
| 29.                                                       | Antipsychotics: Chlorpromazine hydrochloride, Haloperidol<br>Chlorpromazine, Olanzapine,                                                                                           |  |
| 30.                                                       | Antipsychotics: Risperidone, Sulpiride, Quetiapine, Lurasidone                                                                                                                     |  |
| 31.                                                       | Ethosuximide,                                                                                                                                                                      |  |
| 32.                                                       | Anticonvulsants: Clonazepam, Primidone, Valproic acid,<br>Gabapentin, Lamotrigine                                                                                                  |  |
| 33.                                                       | hydrochloride,                                                                                                                                                                     |  |
| 34.                                                       | Anti-depressant: Venlafaxine, Duloxetine, Sertraline, Citalopram,<br>Escitalopram, Fluvoxamine, Paroxetine                                                                         |  |
|                                                           | <b>CLASS TEST</b>                                                                                                                                                                  |  |
| <b>Module 6: Drugs Acting on Autonomic Nervous System</b> |                                                                                                                                                                                    |  |
| 35.                                                       | Sympathomimetic agents: Direct acting: Nor-epinephrine,<br>Epinephrine, Phenylephrine, Dopamine, Terbutaline, Salmeterol,<br>Salbutamol, Albuterol, Naphazoline, Tetrahydrazoline. |  |
| 36.                                                       | Indirect acting agents: Hydroxyamphetamine, Pseudoephedrine,<br>Propylhexadrine. Agents with mixed mechanism: Ephedrine,<br>Metaraminol.                                           |  |
| 37.                                                       | Adrenergic Antagonists: Alpha adrenergic blockers: Tolazoline,<br>Phentolamine, 9 Phenoxybenzamine, Prazosin                                                                       |  |
| 38.                                                       | Beta adrenergic blockers: Propranolol, Atenolol, Carvedilol                                                                                                                        |  |
| 39.                                                       | Cholinergic drugs and related agents: Direct acting agents:<br>Acetylcholine, Carbachol, Pilocarpine.                                                                              |  |
| 40.                                                       | Cholinesterase inhibitors: Neostigmine, Edrophonium chloride,<br>Tacrine hydrochloride, Pralidoxime chloride, Echothiophate iodide.                                                |  |
| 41.                                                       | Cholinergic Blocking agents: Solanaceous alkaloids and analogues:<br>Atropine sulphate, Ipratropium bromide.                                                                       |  |
| 42.                                                       | Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate<br>hydrochloride, Clindinium bromide, Dicyclomine hydrochloride                                                 |  |
| 43.                                                       | Synthetic cholinergic blocking agents: Tridihex ethylchloride,<br>Isopropamide iodide, and Ethopropazine hydrochloride                                                             |  |
|                                                           | <b>CLASS TEST</b>                                                                                                                                                                  |  |
| <b>Module 7: Drugs acting on Cardiovascular System</b>    |                                                                                                                                                                                    |  |
| 44.                                                       | Anti-arrhythmic Drugs: Quinidine sulphate, Procainamide<br>hydrochloride, Verapamil, Phenytoin sodium                                                                              |  |
| 45.                                                       | Anti-arrhythmic Drugs: Lorcanide hydrochloride, amiodarone and<br>Sotalol                                                                                                          |  |
| 46.                                                       | Anti-hypertensive Agents: Propranolol, Captopril, Ramipril,<br>Methyldopate Hydrochloride                                                                                          |  |
| 47.                                                       | Anti-hypertensive Agents: Clonidine hydrochloride., Hydralazine<br>hydrochloride, Nifedipine                                                                                       |  |
| 48.                                                       | Antianginal agents: isosorbide dinitrate                                                                                                                                           |  |
|                                                           | <b>CLASS TEST</b>                                                                                                                                                                  |  |
| <b>Module 8: Diuretics</b>                                |                                                                                                                                                                                    |  |
| 49.                                                       | Acetazolamide, frusemide, bumetanide, metolazone                                                                                                                                   |  |
| 50.                                                       | Chlorthiazide, benzthiazide, xipamide, spironolactone                                                                                                                              |  |
|                                                           | <b>CLASS TEST</b>                                                                                                                                                                  |  |
| <b>Module 9: Hypoglycemic agents</b>                      |                                                                                                                                                                                    |  |
| 51.                                                       | Insulin and its preparations, metformin, glibenclamide                                                                                                                             |  |
| 52.                                                       | Glimepiride, pioglitazone, repaglinide, gliflozins, gliptins                                                                                                                       |  |
| <b>Module 10: Analgesic and anti-inflammatory agents</b>  |                                                                                                                                                                                    |  |

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| 53.                                      | Morphine analogues, Narcotic antagonists; Nonsteroidal anti-inflammatory agents (NSAIDs) aspirin, diclofenac, ibuprofen,          |  |
| 54.                                      | Nonsteroidal anti-inflammatory agents (NSAIDs) piroxicam, celecoxib, mefenamic acid, paracetamol, aceclofenac                     |  |
|                                          | <b>CLASS TEST</b>                                                                                                                 |  |
| <b>Module 11: Anti-Infective Agents</b>  |                                                                                                                                   |  |
| 55.                                      | Antifungal Agents: Amphotericin-B, Griseofulvin, Miconazole, Ketoconazole, Itraconazole, Fluconazole, Naftifine Hydrochloride     |  |
| 56.                                      | Urinary Tract Anti-Infective Agents: Norfloxacin, Ciprofloxacin, Ofloxacin, Moxifloxacin,                                         |  |
| 57.                                      | Anti-Tubercular Agents: INH, Ethambutol, Para Amino Salicylic Acid, Pyrazinamide                                                  |  |
| 58.                                      | Rifampicin, Bedaquiline, Delamanid, Pretomanid                                                                                    |  |
| 59.                                      | Antiviral Agents: Amantadine Hydrochloride, Idoxuridine, Acyclovir, Foscarnet                                                     |  |
| 60.                                      | Zidovudine, Ribavirin, Remdesivir, Favipiravir                                                                                    |  |
| 61.                                      | Antimalarials: Quinine Sulphate, Chloroquine Phosphate, Primaquine Phosphate, Mefloquine, Cycloguanil, Pyrimethamine, Artemisinin |  |
| 62.                                      | Sulfonamides: Sulfanilamide, Sulfadiazine, Sulfamethoxazole, Sulfacetamide, Mafenide Acetate, Cotrimoxazole, Dapsone              |  |
|                                          | <b>CLASS TEST</b>                                                                                                                 |  |
| <b>Module 12: Antibiotics</b>            |                                                                                                                                   |  |
| 63.                                      | Penicillin G                                                                                                                      |  |
| 64.                                      | Amoxicillin                                                                                                                       |  |
| 65.                                      | Cloxacillin                                                                                                                       |  |
| 66.                                      | Streptomycin                                                                                                                      |  |
| 67.                                      | Tetracyclines: Doxycycline                                                                                                        |  |
| 68.                                      | Tetracyclines: Minocycline                                                                                                        |  |
| 69.                                      | Macrolides: Erythromycin                                                                                                          |  |
| 70.                                      | Macrolides: Azithromycin                                                                                                          |  |
| 71.                                      | Miscellaneous: Chloramphenicol                                                                                                    |  |
| 72.                                      | Miscellaneous: Clindamycin                                                                                                        |  |
|                                          | <b>CLASS TEST</b>                                                                                                                 |  |
| <b>Module 13: Anti-Neoplastic Agents</b> |                                                                                                                                   |  |
| 73.                                      | Cyclophosphamide, Busulfan, Mercaptopurine, Fluorouracil,                                                                         |  |
| 74.                                      | Methotrexate, Dactinomycin, Doxorubicin Hydrochloride,                                                                            |  |
| 75.                                      | Vinblastine Sulphate, Cisplatin, Dromostanolone Propionate                                                                        |  |
|                                          | <b>CLASS TEST</b>                                                                                                                 |  |

| Practical day | Practical topic                                                      | Remark / Date |
|---------------|----------------------------------------------------------------------|---------------|
| 1.            | To perform the limit test for Chlorides                              |               |
| 2.            | To perform the limit test for Sulphate                               |               |
| 3.            | To perform the limit test for Iron                                   |               |
| 4.            | To perform the limit test for Heavy metals                           |               |
| 5.            | To perform the identification tests for Anions and Cations as per IP |               |
| 6.            | To prepare and standardize sodium                                    |               |

|     |                                                                            |  |
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|     | hydroxide solution                                                         |  |
| 7.  | To prepare and standardize potassium permanganate                          |  |
| 8.  | To perform assay of ferrous sulphate by redox titration                    |  |
| 9.  | Viva voce                                                                  |  |
| 10. | To perform assay of Calcium gluconate by complexometric titration          |  |
| 11. | To perform assay of sodium chloride by modified volhard's method           |  |
| 12. | To perform assay of Ascorbic acid by iodimetry                             |  |
| 13. | To perform the assay of Ibuprofen by alkalimetry                           |  |
| 14. | To determine melting point and boiling point of prepared organic compounds |  |
| 15. | File checking                                                              |  |
| 16. | Viva voce                                                                  |  |
| 17. | To synthesize benzoic acid from benzamide                                  |  |
| 18. | To prepare picric acid from phenol                                         |  |
| 19. | To perform test of identification and purity for aspirin                   |  |
| 20. | To perform test of identification and purity for caffeine                  |  |
| 21. | Viva voice                                                                 |  |
| 22. | To perform test of identification and purity for paracetamol               |  |
| 23. | To perform test of identification and purity for sulfanilamide             |  |
| 24. | Viva voice                                                                 |  |