SILVER OAK UNIVERSITY

Silver Oak College of Pharmacy (067)
Programme Name: D. Pharm (18)
Subject Name: Pharmaceutical Chemistry
Subject Code: 1180672102
Year: I

Prerequisite:

1. 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.

Objective: Upon completion of the course student shall be able to

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

Teaching Scheme:

Teaching Scheme				
L	T	P	Contact Hours	Credit
4	1	3	8	8

Content:

Unit No.	Contents	Teaching Hours	Weightage %
1	**Introduction to Pharmaceutical chemistry**: Scope and objectives **Sources and types of errors:** Accuracy, precision, significant figures **Impurities in Pharmaceuticals**: Source and effect of impurities in Pharmacopeial substances, importance of limit test, Principle and procedures of Limit tests for chlorides, sulphates, iron, heavy metals and arsenic.	8	11
2	**Volumetric analysis**: Fundamentals of volumetric analysis, Acid-base titration, non-aqueous titration, precipitation titration, complexometric titration, redox titration **Gravimetric analysis**: Principle and method.	8	11
3	**Inorganic Pharmaceuticals**: Pharmaceutical formulations, market preparations, storage conditions and uses of	7	9

	Haematinics: Ferrous sulphate, Ferrous fumarate, Ferric ammonium citrate, Ferrous ascorbate, Carbonyl iron **Antacids:** Aluminum hydroxide gel, Magnesium hydroxide, Magaldrate, Sodium bicarbonate, Calcium Carbonate **Anti-microbial agents:** Silver Nitrate, Ionic Silver, Chlorhexidine Gluconate, Hydrogen peroxide, Boric acid, Bleaching powder, Potassium permanganate **Dental products:** Calcium carbonate, Sodium fluoride, Denture cleaners, Denture adhesives, Mouth washes **Medicinal gases:** Carbon dioxide, nitrous oxide, oxygen		
4	Introduction to nomenclature of organic chemical systems with particular reference to heterocyclic compounds containing up to Three rings	2	3
Study of the following category of medicinal compounds with respect to classification, chemical name, chemical structure (compounds marked with*) uses, stability and storage conditions, different types of formulations and their popular brand names			
5	**Drugs Acting on Central Nervous System** **Anaesthetics:** Thiopental Sodium*, Ketamine Hydrochloride*, Propofol **Sedatives and Hypnotics:** Diazepam*, Alprazolam*, Nitrazepam, Phenobarbital* **Antipsychotics:** Chlorpromazine Hydrochloride*, Haloperidol*, Risperidone*, Sulpiride*, Olanzapine, Quetiapine, Lurasidone **Anticonvulsants:** Phenytoin*, Carbamazepine*, Clonazepam, Valproic Acid*, Gabapentin*, Topiramate, Vigabatrin, Lamotrigine ● **Anti-Depressants:** Amitriptyline Hydrochloride*, Imipramine Hydrochloride*, Fluoxetine*, Venlafaxine, Duloxetine, Sertraline, Citalopram, Escitalopram, Fluvoxamine, Paroxetine	9	13
6	**Drugs Acting on Autonomic Nervous System** **Sympathomimetic Agents:** Direct Acting: Nor Epinephrine*, Epinephrine, Phenylephrine, Dopamine*, Terbutaline, Salbutamol (Albuterol), Naphazoline*, Tetrahydrozoline. **Indirect Acting Agents:** Hydroxy Amphetamine, Pseudoephedrine. Agents With Mixed Mechanism: Ephedrine, Metaraminol **Adrenergic Antagonists:** Alpha Adrenergic Blockers: Tolazoline, Phentolamine Phenoxybenzamine, Prazosin. Beta Adrenergic Blockers: Propranolol*, Atenolol*, Carvedilol **Cholinergic Drugs and Related Agents:** Direct Acting Agents: Acetylcholine*, Carbachol, And Pilocarpine. Cholinesterase Inhibitors: Neostigmine*, Edrophonium Chloride, Tacrine	9	12

	Hydrochloride, Pralidoxime Chloride, Echothiopate Iodide **Cholinergic Blocking Agents**: Atropine Sulphate*, Ipratropium Bromide **Synthetic Cholinergic Blocking Agents:** Tropicamide, Cyclopentolate Hydrochloride, Clidinium Bromide, Dicyclomine Hydrochloride*		
7	**Drugs Acting on Cardiovascular System** **Anti-Arrhythmic Drugs:** Quinidine Sulphate, Procainamide Hydrochloride, Verapamil, Phenytoin Sodium*, Lidocaine Hydrochloride, Lorcainide Hydrochloride, Amiodarone and Sotalol **Anti-Hypertensive Agents:** Propranolol*, Captopril*, Ramipril, Methyldopate Hydrochloride, Clonidine Hydrochloride, Hydralazine Hydrochloride, Nifedipine, **Antianginal Agents**: Isosorbide Dinitrate	5	7
8	**Diuretics:** Acetazolamide, Frusemide*, Bumetanide, Chlorthalidone, Benzthiazide, Metolazone, Xipamide, Spironolactone	2	3
9	**Hypoglycemic Agents:** Insulin and Its Preparations, Metformin*, Glibenclamide*, Glimepiride, Pioglitazone, Repaglinide, Gliflozins, Gliptins	3	4
10	**Analgesic And Anti-Inflammatory Agents:** Morphine Analogues, Narcotic Antagonists; Nonsteroidal **Anti-Inflammatory Agents (NSAIDs)** - Aspirin*, Diclofenac, Ibuprofen*, Piroxicam, Celecoxib, Mefenamic Acid, Paracetamol*, Aceclofenac	3	4
11	**Anti-Infective Agents** **Antifungal Agents:** Amphotericin-B, Griseofulvin, Miconazole, Ketoconazole*, Itraconazole, Fluconazole*, Naftifine Hydrochloride **Urinary Tract Anti-Infective Agents**: Norfloxacin, Ciprofloxacin, Ofloxacin*, Moxifloxacin, **Anti-Tubercular Agents**: INH*, Ethambutol, Para Amino Salicylic Acid, Pyrazinamide, Rifampicin, Bedaquiline, Delamanid, Pretomanid* **Antiviral Agents:** Amantadine Hydrochloride, Idoxuridine, Acyclovir*, Foscarnet, Zidovudine, Ribavirin, Remdesivir, Favipiravir **Antimalarials:** Quinine Sulphate, Chloroquine Phosphate*, Primaquine Phosphate, Mefloquine*, Cycloguanil, Pyrimethamine, Artemisinin **Sulfonamides:** Sulfanilamide, Sulfadiazine, Sulfametho xazole, Sulfacetamide*, Mafenide Acetate, Cotrimoxazole, Dapsone*	8	11
12	**Antibiotics:** Penicillin G, Amoxicillin*, Cloxacillin,	8	11

	Streptomycin, **Tetracyclines**: Doxycycline, Minocycline, **Macrolides:** Erythromycin, Azithromycin, **Miscellaneous:** Chloramphenicol* Clindamycin		
13	**Antibiotics:** Penicillin G, Amoxicillin*, Cloxacillin, Streptomycin, Tetracyclines: Doxycycline, Minocycline, Macrolides: Erythromycin, Azithromycin, Miscellaneous: Chloramphenicol* Clindamycin	3	4

Course Outcome:

Sr. No.	CO statement
CO-1	Describe the chemical class, structure and chemical name of the commonly used drugs and pharmaceuticals of both organic and inorganic nature
CO-2	Discuss the pharmacological uses, dosage regimen, stability issues and storage conditions of all such chemical substances commonly used as drugs
CO-3	Describe the quantitative and qualitative analysis, impurity testing of the chemical substances given in the official monographs
CO-4	Identify the dosage form & the brand names of the drugs and pharmaceuticals popular in the marketplace

Teaching & Learning Methodology: -

The various methods or tools follows by the faculties to teach the above subject are:

1. Student-centred learning.
2. Experiential learning.
3. Power Point Presentation

List of Tutorials/Experiments:

Students will perform following Experiments OR

The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.

1. **Limit test for:** Chlorides; sulphate; Iron; heavy metal.
2. Identification tests for Anions and Cations as per Indian Pharmacopoeia
3. **Fundamentals of volumetric analysis:** Preparation of standard solution and standardization of Sodium Hydroxide, Ceric Ammonium Sulfate, Potassium Permanganate
4. Assay of the following compounds
   - Ferrous sulphate- by redox titration
   - Calcium gluconate-by complexometric
   - Sodium chloride-by Modified Volhard's method
   - Ascorbic acid by cerimetry
   - Metronidazole by Non-Aqueous Titration
   - Ibuprofen by alkalimetry

5. **Fundamentals of preparative organic chemistry** Determination of Melting point and boiling point of organic compounds

6. **Preparation of organic compounds**

- Acetanilide from aniline
- Aspirin from salicylic acid

7. Identification and test for purity of pharmaceuticals Aspirin, Caffeine, Paracetamol, Sulfanilamide

8. Systematic Qualitative analysis experiments (4 substances)

Books Recommended: - (minimum 3 books)

1. A.H. Beckett & J.B. Stenlake's, Practical Pharmaceutical Chemistry Vol I & II, Stahlone Press of University of London
2. A.I. Vogel, Text Book of Quantitative Inorganic analysis
3. P. Gundu Rao, Inorganic Pharmaceutical Chemistry
4. Bentley and Driver's Textbook of Pharmaceutical Chemistry
5. John H. Kennedy, Analytical chemistry principles
6. Indian Pharmacopoeia.
7. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
8. Foye's Principles of Medicinal Chemistry.
9. Burger's Medicinal Chemistry, Vol I to IV.
10. Introduction to principles of drug design- Smith and Williams.

List of Open-Source Software/learning website:

- http://silveroakuni.ac.in/video-lecture
- https://nptel.ac.in/
- https://nptel.ac.in/courses/112/105/112105124/