University of Kerala

Discipline	CHEMISTRY				
Course Code	**UK3DSECHE207**				
Course Title	**MEDICINAL AND PHARMACEUTICAL CHEMISTRY I**				
Type of Course	**DSE**				
Semester	3				
Academic Level	200-299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-	-	4
Pte-requisites	Basic knowledge on organic chemistry				
Course Summary	Introduction to the drug discovery process, Historical perspectives and milestones, Importance of drug discovery in healthcare. Opportunities for innovation in this field. This course outline provides a comprehensive overview of the stages of drug discovery, from lead discovery to regulatory considerations, while also covering essential concepts such as pharmacokinetics and familiarize the pharmacological terms involved.				

Detailed Syllabus:

Module	Unit	Content	Hrs 60
I	**TERMINOLOGIES IN DRUG DISCOVERY AND DEVELOPMENT**		**9**
	1	Introduction to Medicinal and Pharmaceutical chemistry; Important aspects of pharmaceutical chemistry, Role of Chemistry in Pharmacy.	3
	2	Terminologies in Pharmaceutical Chemistry-Pharmacy, Pharmacology, Molecular pharmacology, Pharmacodynamics, Pharmacophore, Pharmacodynamic agents, Antimetabolite, Pharmacokinetics, Bacteria, Virus, Fungi and Mutation	3
	3	Definition of Monograph - types of Monographs (Pharmacopoeial, Regulatory, Scientific, Manufacturers and Analytical Monograph), Organization of Pharmacopoeial Monograph and its significance. Features of Indian Pharmacopoeia.	3
II	**DRUG DESIGN AND DEVELOPMENT**		**18**
	4	Definition of Drugs-Classification based on -Chemical structure and Therapeutic action (only basic knowledge), Introduction to stages of drug discovery (only the steps involved), different targets, target-identification/validation	5
	5	Definition of Lead-Lead identification, Lead optimization, Search for bioactive lead compounds from natural source (Cocaine, Quinine)	3

	6	Serendipity-Accidental Lead Discovery- Penicillin, Sildenafil and Insulin	2
	7	Definition Primary and secondary metabolites - in plants and animals(examples), Metabolism of Drug-Inactivation, Active metabolite from active drug, Activation of inactive drug. Examination of metabolites (eg: paracetamol)	3
	8	Side effect of drug-Predictable and Unpredictable. Exploitation of side effect of drug (eg: Minoxidil)	1
	9	Need of molecular modification of Lead Compound-Modification of progestron as an example (structure of progestron and orally active modified compound)	2
	10	Drug potency - familiarize the terms ED_{50}, LD_{50}, IC_{50}, TI (Therapeutic index) Bioassay: *in vitro* test and *in vivo* test and its importance.	2
III	**INTRODUCTION TO PHARMACOGNOSY AND EVALUATION OF CRUDE DRUG**		**9**
	11	Definition, history, present status and scope of Pharmacognosy	2
	12	Elementary idea on classification of drugs: Alphabetical -Taxonomical - Pharmacological - Chemical - Chemo-taxonomical.	3
	13	Quality control of crude drugs: Different methods of adulteration of crude drugs - Evaluation of crude drug-Organoleptic, Microscopic, Physical, Chemical and Biological.	4
IV	**TRADITIONAL AND MODERN METHODS OF DRUG DEVELOPMENT**		**9**
	14	Drug-Discovery and development in the -Past, Present; Comparison of traditional and modern methods of development of drugs.	2
	15	Drug design by- Method of Variation, Disjunction and Conjunction. Introduction to computer aided drug design (CADD)-Structure Based and Ligand based drug discovery (elementary idea only). Scope of AI in drug discovery (example-alpha fold for protein structure prediction)	4
	16	Medicinal Plants of Ayurvedic importance – common name- traditional uses - Major phytochemical constituents-*Ocimum tenuiflorum* (Thulsi), *Azadirachta indica* (Neem), *Vinca rosea* (Madagascar Periwinkle), *Indigofera tinctoria* (Nilamari), *Adhatoda vasica* (Adalodakam), *Curcuma longa* (Turmeric), *Cymbopogon citratus* (lemon grass), *Zingiber officinale* (Ginger), *Aloe vera*, *Plectranthus amboinicus* (Panikkurka), *Clitoria ternatea* (Shankupushpam).	3
V	**OPEN ENDED MODULE: Learning through Discussion, Assignment, Presentation, Quizzes, Open book exams etc**		**15**
	1	Provide examples of successful target identification and validation processes in drug discovery. Ask students to analyze these cases and discuss the importance of target selection. Presentation on topic Virus to Vaccine: The Journey of COVID-19 Vaccine Development	
	2	Students search the stories behind the accidental discoveries till now and discuss the implications for modern drug discovery	
	3	Assignment to identify the medicinal plants of regional importance and find the major bioactive metabolites and its medicinal values.	
	4	Conduct power point presentation on classification of drugs elucidating	

		examples each based on Alphabetical, Taxonomical, Pharmacological, Chemical and Chemo-taxonomical classification.	
	5	Conduct quiz on regional name and botanical name of various medicinal plants of Ayurvedic importance	
	6	Ask student to Choose **any one or two** real-life examples of drugs or research projects where CADD made a difference.	

References

1. Patrick, G.L. (2013). *Introduction to Medicinal Chemistry* (5th Edition). UK: Oxford University Press.
2. Patrick G, (2002), *Instant Notes Medicinal Chemistry*, Viva Books Private Limited, New Delhi.
3. Chatwal G R, (1991), *Pharmaceutical chemistry, organic (vol-II)*., Himalaya publishing house, Bombay.
4. D. Sriram & P. Yogeeswari, *Medicinal Chemistry*, 2nd Edition
5. K.R. Arumugam and Dr. N. Murugesh, *A Text Book of Pharmacognosy*.
6. K.D Tripathi, *Essentials of Medical pharmacology*, 8th edition.
7. Tara V Shanbhag and Smita Shenoy*, Pharmacology for Medical Graduates*, 4th edition
8. Hakishan, V.K. Kapoor, (2017). *Medicinal and Pharmaceutical Chemistry*, New Delhi: Vallabh Prakashan. Pitampura
9. Jayashree Ghosh, (1999), *A text book of pharmaceutical chemistry*, 2nd ed., S. Chand & company, New Delhi.
10. Padmaja Udayakumar, *Medical pharmacology*, CBS Publishers and Distribution Pvt Ltd.
11. *Principles of Medicinal Chemistry: Modern Methods in Drug Design*: John Smith, Emily Johnson: Wiley,2020.
12. *A handbook of common Medicinal Plants in Ayurveda*
13. *Indian Medicinal Plants*: C.P. Khare (available online).

Course Outcome

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand basic principles of medicinal and pharmaceutical chemistry, including essential terminologies and classification of drugs.	An	3,5
CO-2	Apply the importance of functional group and the structure of compounds in various pharmacological activity.	C	1,3
CO-3	Identify and evaluate different types of adulteration in crude drugs and apply standard methods of quality control. Perform basic evaluation of crude drugs using different methods.	An	1,5

CO-4	These topics equip students with a comprehensive understanding of natural drugs, their origins, chemical constituents, and therapeutic applications	E	1,3
CO-5	These tasks provide a comprehensive understanding of various aspects of drug discovery, from target identification to drug classification and traditional medicine. They foster critical thinking, research skills, and an appreciation for the complexities of modern pharmacology.	C	1,2,3

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: MEDICINAL AND PHARMACEUTICAL CHEMISTRY I

Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	CO-1	PSO-3,5 PO-2,4	An	F	L	-
2	CO-2	PSO-1,3 PO-1	C	C, P	L/T	-
3	CO-3	PSO-1,5 PO-3	An	F, C	L/T	-
4	CO- 4	PSO-1,3 PO-1	E	C, P	L	-
5	CO- 5	PSO-1,2,3 PO-2	C	C, P	L/T	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO 1	-	-	2	-	1	-	1	-	2	-	-	-	-
CO 2	1	-	3	-	-	2	-	-	-	-	-	-	-
CO 3	2	-	-	-	2	-	-	2	-	-	-	-	-
CO 4	3	-	2	-	-	3	-	-	-	-	-	-	-

CO 5	1	2	1	-	-	-	3	-	-	-	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4	✓	✓	✓	✓
CO 5		✓	✓	