Handbook-Department of Pharmacology



Faculty of Medicine Sabaragamuwa University of Sri Lanka

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Pharmacology comes from the Greek word *pharmacon* (drug) and *logia* (study) and provides the scientific basis of drug action at the molecular, cellular and organ system level. Therapeutics links the knowledge of disease to how medicines (drugs) influence the disease process. Prescribing medicines takes place in all disciplines of medical practice.

Clinical pharmacology and therapeutics is an important part of the MBBS curriculum because understanding the principles of drug therapy is important for safe, effective, and rational prescribing.

The aim of this course is to provide the core knowledge to link the action of medicines at the molecular, cellular and organ system level to a range of beneficial and adverse effects seen in therapeutic use and to the skills to be fulfilled in the prescribing process.

The Time Table

The course in Pharmacology spans from 4th to 7th semesters in the medical curriculum. Every student will have approximately 3 - 4 hours of contact time per week with the staff in the department during the course. These are distributed among the various teaching learning activities, which are described in detail below. The approximate number of hours that are set aside for Pharmacology during the course are as follows:

Semester	Subject area	No. of hours allocated for Teaching/Learning methods	
		Lectures	SGD
	Lectures in General Pharmacology	18	10
4	Lectures in antimicrobial agents	12	04
	Drugs used in anesthesia	02	02
	Therapeutics	01	
	Drugs used in cardiology	08	04
	Drugs used in pulmonology	02	02
5	Drugs used in genitourinary disorders	01	01
	Drugs used in gastroenterology	04	02
	Therapeutics	09	
	Drugs used in rheumatology	02	01
	Drugs used in endocrinology & reproductive medicine	10	04
6	Drugs used in neurology	05	04
	Therapeutics	08	
	Drugs used in psychiatry	04	05
	Drugs used in Toxicology	02	01
7	Drugs used in substance use disorders	01	
	Intravenous fluids	01	

Drugs used in miscellaneous conditions	04	02
Essential drugs, pharmacovigilance, pharmacoeconomics, prescription writing & medication safety & errors	05	01
Therapeutics	02	

Academic programme

DEPARTMENT OF PHARMACOLOGY

ACADEMIC STAFF

Senior Lecturer

Dr. R.M.M.K.Namal Rathnayaka

MBBS (Pera), PhD (Pera), MPhil (Pera), MMEd, MSc in Toxicology (Col), MSc in Clinical Pharmacology & Therapeutics (Col), MA (Budhhist & Pali University of SL), Dip in Toxicology (Col), Dip in Occupational Health & Safety (Col), Postgrad. Dip in Buddhist Studies (Budhhist & Pali University of SL), PGCert.Med.Ed – Head of Department

LEARNING OUTCOMES OF THE COURSE IN PHARMACOLOGY

(COURSE LEARNING OUTCOMES-CLOs)

At the completion of this course, the students should be able to:

- 1. Describe the basic principles and concepts in Pharmacology
- 2. Explain the pharmacological basis of the drugs used in the management of diseases of different organ systems
- 3. Demonstrate skills in evidence-based prescribing
- 4. Discuss the importance of preventing medication errors in improving patient safety
- 5. Identify the policies in medicine management
- 6. Describe the pharmacological principles in Toxicology

7. Describe the role of the doctor in preventing misuse of drugs

COURSE STRUCTURE

Year 2 Semester 4

Lectures

Year 3 Semester 5 to Year 3 Semester 6

• Lectures

Year 4 Semester 7

Lectures

-33 hours

-49 hours

-19 hours

Semester	Lecture hrs	Tutorial hrs	Total hrs
4 (2 nd year)	33	16	49
5 (3 rd year)	24	9	33
6 (3 rd year)	25	9	34
7 (4 th year)	19	9	28
Total	101	43	144

Student centered learning (SCL) hrs: 43 Student directed learning (SDL) hrs:306 (450-144)

COURSE CONTENT

- General Pharmacology
- Antimicrobial agents
- Drugs used in Anaesthesia
- Systemic Pharmacology and Therapeutics
 - Drugs used in: Cardiology
 - Pulmonology
 - Genito-urology
 - Gastroenterology

- Immunology
- Endocrinology and reproductive system
- Toxicology
- Neurology
- Psychiatry

TEACHING AND LEARNING METHODS

- Lectures, face-to-face and online
- Small group discussions (SGD)
- Tutorials

ASSESSMENT STRATEGY

End Semester Examination /Continuous Assessment (CA)				
Method of Number of Questions Marks Time				
Assessment		allocated	allocated	
CA 1				
MCQ	15 T/F + 5 SBAs = 20	100%	1 hr	
Weightage		3%		
CA 2				
MCQ	15 T/F + 5 SBAs = 20	100%	1 hr	
Weightage		5%		
CA3	15 T/F + 5 SBAs = 20	100%	1 hr	
Weightage		6%		
CA4	15 T/F + 5 SBAs = 20	100%	1 hr	
Weightage		6%		
Final Examinatio	n /Third MBBS Part II Exam	nination (Main)		
MCQ	15 T/F + 3 SBAs + 3	40%	1 hr 45 min	
	EMQs			
	(4 scenarios each) = 30			
SEQ	6	40%	1 ½ hrs	
CA		20%		
Total marks		100%		
Final Examinatio	n / Third MBBS Part II Exan	nination (Subs	equent)	
MCQ	15 T/F + 3 SBAs + 3 EMQs	40%	1 hr 45 min	
	(4 scenarios each) = 30			
SEQ	6	40%	1 ¹ / ₂ hrs	
Total marks		80% [upgrad	e to 100]	

Eligibility to sit for the End Semester Assessments & 3rd MBBS part 2 Examination

- 100% attendance for tutorials and SGDs should be there.
- Minimum of 80% attendance for tutorials and SGDs is considered with valid medical certificates or approved leave for any absence.
- Those who do not obtain a minimum of 80% attendance will have to appear for the subsequent examination, which would be considered a second attempt.

CREDIT VALUES

Description of Teaching/Learning activity	Contact Hours	Independent Student Learning (ISL) Hours	National Hours	Calculation of Credit Value	Credit Value
Lectures	101	202	303	303/50	6.06
Total – Faculty based learning (Tutorials)	43	86	129	129/50	2.58
Interactive Clinical Lecture Demonstration (CLDs)	0	0	0	0/50	0
Skill Lab/Simulation Centre sessions	0	0	0	0/50	0
Experiential Learning – Clerkship/Fieldwork, research and report	0	0	0	0/100	0
Total credit value of Pharmacology	144	288	432		8.64 Credits

RECOMMENDED BOOKS

- Rang and Dale's Pharmacology. Rang HP, Date MM, Ritter JM, Flower RJ & Henderson G.
 9th Edition 2020. Elsevier
- Clinical Pharmacology. Bennett PN, Brown MJ. 12th Edition 2018, Elsevier Churchill Livingstone, London.
- Basic and clinical Pharmacology. Katzung BG, Masters SB, Trevor AJ. 14th Edition 2017. McGraw Hill Medical, New York.

ADDITIONAL READING (OPTIONAL)

- Sri Lankan Prescriber. State Pharmaceuticals Corporation of Sri Lanka.
- British National Formulary. 2021, BMJ Publishing Group Ltd and Royal Pharmaceutical Society.
- Sri Lanka Student Formulary. 2018, Department of Pharmacology, Faculty of Medicine, University of Colombo and Ministry of Health, Nutrition & Indigenous Medicine, Sri Lanka.
- Australian Prescriber. NPS MEDICINEWISE, Level 5, 15 Moore Street Canberra ACT 2600.
- Foundations of Pharmacology for students of Medicine and Allied Health Sciences. Jayakody RL. 2009. Ananda Press, Colombo 13.

 Goodman & Gilman's the Pharmacological basis of Therapeutics. 13th Edition. 2018, McGraw Hill Education, New York.

Latest edition is recommended for all books

Intended learning outcomes (ILOs)

Semester 4

- **1.** Introduction to Pharmacology *The student should be able to*
 - Define the following terms: Drug, medicine, pharmacology, therapeutics, clinical pharmacology, experimental pharmacology, pharmacokinetics, pharmacodynamics, generic and brand names
 - List different sources of drug information

2. Pharmacodynamics

4 hours

1 hour

The student should be able to

- Define the term pharmacodynamics
- List the types of drug targets
- Compare and contrast receptor types in relation to the mechanism of activation and function
- Explain how ion channels, enzymes and transporters act as drug targets
- Explain the terms potency and efficacy
- Define full agonists, partial agonists, antagonists & inverse agonists in relation to receptors
- Explain the concept of synergism of drug action
- Explain the difference between the linear and semi-logarithmic dose response curves
- Draw and interpret the semi-logarithmic dose response curves for the following situations:
 - Full agonist
 - Partial agonist
 - Inverse agonist
 - Full agonist in the presence of a fixed amount of competitive agonists
 - Full agonist in the presence of a fixed amount of non-competitive antagonist
 - Full agonist in the presence of a fixed amount of partial agonist
 - Full agonist in the presence of a fixed amount of inverse agonist
- Define the terms "tolerance" and "dependence"
- Describe the mechanisms of tolerance
- Explain placebo and nocebo effects

3. Pharmacokinetics

6 hours

The student should be able to

- List the components (processes) of pharmacokinetics
- Describe the mechanisms by which drugs are transported across the cell membrane
- Describe the mechanisms of drug absorption
- List the different routes of drug administration and
 - Describe the advantages and disadvantages of each of the routes
 - Decide on the most appropriate route of administration for a given clinical situation
- Explain the clinical importance of pH trapping of weak acids/bases
- List the factors affecting drug distribution in the body
- Describe the concept of body fluid compartments in relation to drug distribution
- Explain the clinical relevance of binding of drugs to plasma proteins
- Define apparent volume of distribution
- Explain the concept of re-distribution of drugs
- Explain the significance of tissue barriers (blood brain barrier, placental barrier)
- Define drug metabolism
- Describe the different mechanisms of drug metabolism
- Describe the factors that influence the metabolism of drugs
- Define bioavailability & bioequivalence
- Explain the clinical relevance of bioavailability
- Relate the concept of first pass elimination to bioavailability
- List the mechanisms of drug elimination
- Explain how the lipid/water solubility of a drug affects its elimination
- Explain the effects of renal and hepatic impairment on drug elimination
- Explain the enterohepatic recycling of drugs
- Compare first order and zero order kinetics
- Explain loading dose and maintenance dose
- Define steady state plasma drug concentration
- Define plasma half-life and biological half life
- Explain the mechanisms used for prolongation of drug action
- Draw the concentration-time curves for:

- Single intravenous bolus injection
- Single intramuscular injection
- Single subcutaneous injection
- Single dose oral administration
- Continuous intravenous infusion
- Intermittent intravenous bolus injection
- Intermittent oral administration
- Intermittent oral modified release formulation
- 4. Adverse & toxic drug reactions

1 hour

The student should be able to

- Define adverse drug reaction (ADR) & toxic effects of drugs
- Describe different types of ADR
- Explain the difference between predictable and idiosyncratic adverse drug reactions
- Explain drug-induced teratogenicity, impairment of fertility, mutagenicity and carcinogenicity
- List the predisposing factors for ADR
- Explain how to do causality assessment and minimize ADR
- Explain ED₅₀ and LD₅₀
- Define therapeutic index
- Relate the importance of therapeutic index in clinical practice

5. Monitoring of drug therapy

1 hour

The student should be able to

- Describe the methods by which the effects of drug therapy could be assessed
- Describe how the measurement of plasma drug concentrations help in monitoring drug therapy

6. Pharmacogenetics

1 hour

The student should be able to

- Define pharmacogenetics
- Explain the influence of pharmacogenetics on pharmacokinetics and pharmacodynamics of drugs
- Describe how pharmacogenetics influences the response to drug therapy
- Explain the importance of pharmacogenetics in clinical practice
- 7. Drug discovery & development

1 hour

The student should be able to

• Describe the procedure of discovery and development of new drugs

- Describe different types of preclinical studies
- Compare objectives, limitations and implementation of each phase in clinical trials

1 hour

- Describe post marketing surveillance studies (i.e.: phase 4)
- 8. Drug therapy in special populations *The student should be able to*
 - Explain the reasons for taking special precautions in prescribing drugs in pregnancy, breast feeding, renal and hepatic dysfunction, extremes of age
 - Explain the principles underlying the dose adjustments needed in the above situations
- **9.** Introduction to drugs acting on Autonomic Nervous System 1 hour *The student should be able to*
 - Recall the anatomical and functional organization of autonomic nervous system
 - Classify the drugs acting on autonomic nervous system
 - Describe the pharmacodynamics, pharmacokinetics, clinical uses and adverse effects of drugs acting on the autonomic nervous system

10. Analgesics and principles in pain management **1** hour

The student should be able to

- Recall the pain pathway in the nervous system
- State the classification of pain
- Classify drugs used in pain management
- Describe the pharmacodynamics, pharmacokinetics, clinical uses and adverse effects of drugs used in pain management
- Explain the underlying principles in selecting drugs in different clinical situations

11. Introduction to antimicrobial drug therapy1 hour

The student should be able to

- Describe the principles of antimicrobial drug therapy and antimicrobial resistance
- Explain the following terms with examples: Bacteriostatic, Bactericidal, Minimum inhibitory concentration, Time dependent killing, Concentration dependent killing, Post antibiotic effect
- Classify antimicrobial drugs according to the mechanisms of action
- Describe the mechanisms of development of resistance in microbes with

examples

- Identify the factors that contribute to development of antimicrobial resistance in Sri Lanka
- Describe how the emergence of antimicrobial resistance could be minimized
- Describe the concept of antimicrobial stewardship

12. Antimicrobial agents I (Beta Lactam Antibiotics) 2 hours

1. Penicillins

The student should be able to

- State the molecular structure of penicillin and its derivatives
- List the types of penicillins with examples and their spectrum of activity
- Describe the mode of action of penicillins
- Describe pharmacokinetics of penicillins
- List the clinical indications of penicillins and penicillins with beta lactamase inhibitors
- State the adverse effects of penicillins, precautions and contraindications to use them
- State the advantages and disadvantages of the penicillin sensitivity test

2. Cephalosporins and cephamycins

- Describe the mode of action of cephalosporins/ cephamycin
- Classify the cephalosporins & state their spectrum of activity
- Describe the pharmacokinetics of cephalosporins/ cephamycin
- List clinical indications of cephalosporins/ cephamycin
- State adverse effects of cephalosporins/cephamycin and precautions and contraindications to use them

3. Carbapenems and Monobactams

- Describe the mode of action of carbapenems and monobactams
- State their spectrum of activity
- Describe their pharmacokinetics
- List their clinical indications
- State their adverse effects, precautions and contraindications

13. Antimicrobial agents II:

4 hours

- 01. Glycopeptide antibiotics (Vancomycin and Teicoplanin)
- 02. Lincosamide antibiotics (Clindamycin)
- 03. Macrolides
- 04. Quinolones

- 05. Nitroimidazoles
- 06. Aminoglycosides
- 07. Tetracyclines
- 08. Sulfonamides

The student should be able to

- Describe the mode of action of the aforementioned classes of drugs
- State their spectrum of activity
- Describe their pharmacokinetics
- List their clinical indications
- State their adverse effects, precautions and contraindications

14. Antiviral agents

1 hour

The student should be able to

- Classify antiviral agents according to their mode of action
- Describe the pharmacokinetics of antiviral agents
- State the clinical indications of antiviral agents
- State the adverse effects of the above drugs
- State precautions and contraindications of the above drugs
- Describe the use of 'Highly Active Anti-Retroviral Therapy' (HAART) in HIV/AIDS

15. Antifungal agents

1 hour

1 hour

The student should be able to

- Name the different classes of antifungal agents e.g. Polyenes, Allylamines, Azoles, Triazoles, Echinocandins & griseofulvin
- Describe their mechanism of action, pharmacokinetics, clinical indications, adverse effects and precautions

16. Drugs used in helminthic infections

The student should be able to

- Classify the drugs used in the treatment of parasitic diseases.
- Describe the pharmacokinetics of Benzimidazoles, Muscle paralyzers and Diethyl Carbamazine Citrate.
- Discuss the clinical uses, adverse effects, precautions and contraindications of the above drugs.

17. Anti-protozoal agents

1 hour

The student should be able to

- Classify the antibiotic classes that are used in protozoal infections.
- Describe the pharmacokinetics of antiprotozoal drugs
- Discuss the clinical uses, adverse effects, precautions and contraindications in the above drugs.

18. Antimalarial agents

1 hour

The student should be able to

- State the current epidemiology of malaria
- Describe different regimens of drug therapy used in malaria
- Describe pharmacokinetics of the above drugs
- Describe malaria treatment in special situations (cerebral malaria/ malaria in pregnancy)
- State the adverse effects of the above drugs
- State precautions and contraindications of the above drugs

19. Therapeutics: Infections

1 hour

Горіс	No of hours
nfections	1

(Refer to Therapeutics learning objectives)

20. General Anaesthesia (GA)

The student should be able to

1 hour

- Define the term general anaesthesia
- Describe the ideal properties of a general anesthetic agent
- List commonly used iv/ gaseous agents for GA
- List anesthetic agents used for induction and maintenance of GA
- Describe the pharmacological basis of using the above drugs
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of general anesthetic agents.

21. Local Anesthetics (LA) & Neuromuscular Blockers 1 hour

The student should be able to

Describe the ideal properties of a local anesthetic.

- Classify LA.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of local anesthetic agents.
- Describe the pharmacological basis of using adrenaline with LA.
- Classify neuromuscular blockers with examples.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of neuromuscular blockers used in general anesthesia and intensive care.

Total Lecture Hours	33 Hours
Small group discussions	16 hours

2 hour small group discussions will be held on the following topics:

Tutorial Pharmacodynamics
Tutorial: Pharmacokinetics
Tutorial: Adverse drug reactions and therapeutic monitoring
Tutorial on General Pharmacology
Tutorial on Drugs on Autonomic Nervous System
Tutorials on Antimicrobial agents - 02
Tutorial on Anaesthesia

Semester 5

Drugs used in cardiovascular system

- **22.** Drugs influencing the vascular tone2 hoursThe student should be able to2
 - Recall the physiology of regulation of vascular tone
 Describe the mechanism of action, pharmacokinetics, clinical uses,
 important adverse effects, drug interactions and contraindications of,
 - 1. Drugs that increase the intracellular cGMP
 - 2. Drugs that inhibit the catabolism of cGMP
 - 3. Sympatholytic drugs

- 4. Calcium channel blockers
- 5. Drugs acting on the Renin Aldosterone Angiotensin system
- 6. Endothelin receptor antagonists
- 7. Miscellaneous vasodilators (e.g.: minoxidil, nicorandil, hydralazine)
- 8. Vasoconstrictors (sympathomimetics, vasopressin receptor agonists)

23. Drugs influencing myocardial contractility and relaxation 1 hour *The student should be able to*

- Recall the physiology of regulation of myocardial contractility
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs influencing myocardial contractility and relaxation.

24. Drugs influencing cardiac rhythm

1 hour

The student should be able to

- Recall the physiology of cardiac rhythm
- Classify antiarrhythmic drugs according to the Vaughan Williams classification with examples
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs influencing the cardiac rhythm.

25. Lipid regulating drugs

1 hour

The student should be able to

- Recall the normal lipoprotein metabolism and their relevance to cardiovascular disease
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs influencing lipid metabolism.

26. Anticoagulants, thrombolytic & anti-fibrinolytic agents 1 hour

The student should be able to

- Recall the physiology of haemostasis and its regulation.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of,
 - 1. Anticoagulants
 - 2. Fibrinolytic drugs
 - 3. Anti-fibrinolytic drugs
 - 4. Drugs used for reversal of anticoagulation

27. Antiplatelet drugs

1 hour

The student should be able to

- Recall the role of platelets in haemostasis and thrombosis
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of antiplatelet drugs.

28. Drugs influencing the volume status

1 hour

The student should be able to

- Recall the physiology of regulation of volume status of body fluid compartments
- Classify the types of diuretics based on the site of action in the nephron with examples
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of,
 - 1. Diuretics
 - 2. Drugs acting on natriuretic peptide receptors
 - 3. Drugs acting on vasopressin receptors

29. Therapeutics

5 hours

Торіс	No of hours
Hypertension	1
Ischemic Heart Disease (stable angina, unstable angina, myocardial infarction)	1
Chronic heart failure, acute left ventricular failure and cardiogenic shock	1
Arrhythmias	1
Anticoagulation	1

(Refer to Therapeutics learning objectives)

Drugs used in respiratory system

1. Drugs used in asthma & COPD

1 hour

The student should be able to

- Recall the knowledge on pathophysiology of asthma and COPD
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of,
 - 1. Bronchodilators

- 2. Drugs that modulate airway inflammation
- 2. Principles of anti-tuberculosis drugs 1 hour *The student should be able to*
 - List the anti-tuberculous drugs in the first line and second line categories
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of first line drugs used in the treatment of tuberculosis

3. Therapeutics

1 hours

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(Refer to learning objectives in Therapeutics)

Drugs used in genitourinary system

- **1.** Drugs acting on lower urinary tract1 hour*The student should be able to*
 - Recall the anatomy and physiology of lower urinary tract

Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of,

- 1. Drugs used in benign prostatic hyperplasia
- 2. Overactive bladder
- **2.** Therapeutics

2 hours

Торіс	No of hours
Acute kidney injury	1
Chronic kidney disease	1

(Refer to learning objectives in Therapeutics)

Drugs used in gastrointestinal system

- 1. Drugs used in Peptic Ulcer disease/ GORD 1 hour The student should be able to
 - Recall the physiology of gastric acid secretion, mucosal defense mechanisms and upper gastrointestinal motility
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of,
 - 1. Antacids
 - 2. Drugs that inhibit the gastric acid secretion
 - 3. Drugs that enhance the mucosal defense mechanisms
 - Describe the treatment regimens available for the management of *Helicobacter* pylori infection

1 hour

- **2.** Anti-emetics & prokinetic agents *The student should be able to*
 - Recall the physiology of vomiting
 - Classify anti-emetics with examples
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of
 - 1. Anti-emetics
 - 2. Prokinetic agents
 - Explain the selection of an anti-emetic based on the pathophysiology of different clinical situations
- **3.** Antidiarrheal agents, antispasmodics, laxatives 1 hour *The student should be able to*

Antidiarrheal agents

- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of antidiarrheal agents
- Explain the role of antibiotics in the management of diarrhoea

Antispasmodics

 Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of antispasmodics

Laxatives

- Classify laxatives based on the mechanism of action with examples
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of laxatives
- **4.** Drugs used in inflammatory bowel disease
 1 hour

 The student should be able to 1
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs used in inflammatory bowel disease

5. Therapeutics	L hour
Торіс	No of hours
Chronic liver disease	1

(Refer to learning objectives in Therapeutics)

Total Lecture Hours

Small group discussions: 09 hours 1 hour small group discussions will be held on the following topics:

Tutorials on cardiovascular system – 04 -Tutorial on drugs acting on cardiovascular system -Tutorial on systemic hypertension -Tutorial on ischemic heart disease -Tutorial on heart failure Tutorials on respiratory system – 02 -Tutorial on drugs used in asthma & COPD -Tutorial on anti-tuberculosis drugs Tutorials on genitourinary system – 01

24 Hours

20

Tutorials on gastrointestinal system – 02 -Tutorial on drugs acting on gastrointestinal system -Tutorial on chronic liver cell disease

Semester 6

Drugs used in autoimmune and inflammatory diseases

30. Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) 1 hour *The student should be able to*

- Classify NSAIDs
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of NSAIDs

31. Immunomodulatory drugs

1 hour

The student should be able to

- Recall the physiology of immune system
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of immunomodulatory drugs.

(e.g.: Disease modifying anti-rheumatic drugs, glucocorticoids, immunosuppressants, IVIG, biologic immunomodulatory drugs)

32. Therapeutics

1 hours

Торіс	No of hours
Rheumatoid arthritis and connective tissue disorders	1

(Refer to learning objectives in Therapeutics)

Drugs acting on the endocrine and reproductive systems

1. Hypothalamic & Pituitary Hormones *The student should be able to*

1 hour

- Recall the physiological role of the hypothalamus and pituitary in endocrine homeostasis.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs influencing hypothalamic and pituitary function.
 - 1. Hypothalamo-pituitary-growth hormonal axis
 - 2. Hypothalamo-pituitary-prolactin axis
 - 3. Hypothalamo-pituitary-thyroid axis
 - 4. Hypothalamo-pituitary-adrenal axis
 - 5. Hypothalamo-pituitary-gonadal axis
 - 6. Antidiuretic hormone and oxytocin

2. Drugs acting on the thyroid gland

1 hour

The student should be able to

- Recall the physiology of thyroid hormones including its synthesis, storage, secretion and regulation.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs influencing thyroid functions.
- 3. Drugs acting on the adrenal cortex

1 hour

The student should be able to

- Recall the physiology of adrenocortical hormones.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs influencing the adrenal functions. (glucocorticoids, mineralocorticoids, adrenal androgens)
- Describe the consequences of long term glucocorticoid therapy and its abrupt withdrawal.
- 4. Drugs used in diabetes mellitus

2 hours

The student should be able to

- Recall the physiology of glucose metabolism
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of oral anti-diabetic agents.
- Compare and contrast different oral anti-diabetic drugs in relation to their efficacy, mechanism of action, cost and indications.
- Describe the principles of antidiabetic therapy in selected groups (pregnancy, critical illness, during labour and surgery).
- Classify the types insulin based on the duration of action
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of commonly used insulin preparations.
- Describe insulin delivery methods.
- Describe the advice given to a patient commencing on insulin therapy.

- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs acting on GLP-1 receptor agonists.
- **5.** Drugs influencing calcium and bone homeostasis 1 hours *The student should be able to*
 - Recall the physiology of calcium homeostasis, bone structure, its composition and remodeling.
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs influencing calcium homeostasis and bone remodeling.
- 6. Drugs influencing gonadal function3 hoursThe student should be able to
 - Recall the physiology of male and female reproductive systems.
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs influencing androgen activity.
 - Describe the consequences of using anabolic steroids by athletes.
 - List different methods of contraception.
 - Classify hormonal contraceptives in relation to its composition.
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of hormonal contraceptives.
 - Compare and contrast oral and parenteral contraceptive methods.
 - Describe different types of emergency contraceptive methods.
 - Describe the advice given to an individual commencing on hormonal contraceptives.
 - Recall the physiological changes in postmenopausal period.
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs used in postmenopausal hormone therapy.

7. Drugs influencing uterine contractility

The student should be able to

- Recall the physiology labour.
- Classify the drugs that stimulate/inhibit uterine contractions.
- Describe their mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs influencing uterine contractility.
- 8. Therapeutics

3 hours

1 hour

Торіс	No of hours
Diabetes mellitus	1
Osteoporosis & vit D deficiency	1
Thyroid disorders	1

(Refer to learning objectives in Therapeutics)

Drugs used in Neurology

- 1. Introduction to Neuropharmacology1 hourThe student should be able to1
 - Recall the physiology of neurotransmission and neuronal action potential
 - List the important neurotransmitters in the nervous system.
 - List the mechanisms by which drugs influence the function of the nervous system.
- 2. Drugs used in epilepsy and seizure disorders 1 hour *The student should be able to*
 - Describe the pathophysiology and classification of seizures.
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs used in epilepsy and seizure disorders.
- **3.** Drugs used in Parkinsonism & movement disorders 1 hour *The student should be able to*
 - Describe the pathophysiology of movement disorders (Parkinsonism, chorea, dystonia)
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs used in movement disorders.
- **4.** Drugs used in NMJ disorders

1 hour

The student should be able to

• Recall the physiology of the neuromuscular transmission.

- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs acting on the NMJ.
- Describe the basis of use of acetylcholinesterase inhibitors in myasthenia gravis and reversal of the effect of neuromuscular blockers.

5. Drugs used in migraine

1 hour

The student should be able to

- Describe the pathophysiology of migraine.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs used in acute migraine and its prophylaxis.

6. Therapeutics

4 hours

Торіс	No of hours
Eniloney	1
ерперзу	⊥
Stroke	1
Migraine	1
Parkinsonism and movement disorders	1

(Refer to learning objectives in Therapeutics)

Total Lecture Hours

25 Hours

Small group discussions: 1 hour small group discussions will be held on the following topics:

09 hours

Tutorials on rheumatology - 01

Tutorials on endocrinology and reproductive system – 04 -Tutorial on drugs used in thyroid diseases -Tutorial on drugs used in diabetes mellitus -Tutorial on drugs used in calcium and bone homeostasis -Tutorial on drugs used in reproductive system Tutorials on neurology – 04 -Tutorial on drugs used in epilepsy -Tutorial on drugs used in parkinsonism -Tutorial on drugs used in NMJ disorders -Tutorial on drugs used in stroke and migraine

Semester 7

Drugs used in psychiatric disorders

- 1. Hypnotics, Sedatives and anxiolytics 1 hour *The student should be able to*
 - Recall the physiology of sleep-wakefulness cycle.
 - Describe the neurobiology of anxiety.
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of hypnotics, sedatives and anxiolytics.

2. Antipsychotics

1 hour

1 hour

The student should be able to

- Describe the neurobiology of psychosis.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of antipsychotics.
- Compare and contrast classical (1st generation) antipsychotics with atypical (2nd generation) antipsychotics.

3. Antidepressants and mood stabilizers *The student should be able to*

- Describe the neurobiology of depressive disorder and bipolar disorder.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of antidepressants.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of

mood stabilizers.

4. Drugs used in dementia

1 hour

The student should be able to

- Describe the neurobiology of dementia.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs used in dementia.

5. Therapeutics

2 hours

Topic	No of hours
Dementia	1
Dementia	-
Mood disorders	1
	-

(Refer to learning objectives in Therapeutics)

Drugs used in Toxicology

- 1. Basic principles in toxicology & management of poisoning 2 hours *The student should be able to*
 - State the classification of drug toxicity.
 - Explain the mechanisms of drug toxicity.
 - Describe principles of management of acute and chronic poisoning in clinical practice.

Drugs used in substance use disorders

- **1.** Pharmacology on substance use disorders1 hourThe student should be able to1
 - Describe the neurobiology of substance dependence and withdrawal states (ethanol, nicotine, opioids, cannabinoids, amphetamines, cocaine)
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of drugs used in management of substance use disorders.

Intravenous fluids

- 1. Intravenous fluids, parental nutrition and ORS1 hourThe student should be able to
 - Recall the physiological composition of body fluid compartments.
 - Define;
- 1. Crystalloids and colloids
- 2. Isotonic, hypertonic and hypotonic solutions
- 3. Iso-osmolar, hyperosmolar and hypo-osmolar solutions
- Describe the ideal features of IV fluids.
- List the different types of crystalloids and colloids.
- State clinical indications for different IV fluids.
- List common adverse effects of IV fluids.
- List different preparations used in parenteral nutrition
- List indications of parenteral nutrition with examples
- State adverse effects and precautions of parenteral nutrition
- Describe the composition of different Oral Rehydration Solutions (ORS)
- Describe indications for ORS
- Describe the procedure of reconstitution and administration of ORS
- State adverse effects of ORS

Miscellaneous conditions

1. Haemopoietic agents *The student should be able to*

- List the minerals and vitamins required for hematopoiesis.
- Recall the physiology of iron homeostasis.
- Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of iron preparations, folic acid and vitamin B₁₂.

1 hour

- List the haematopoietic growth factors used in clinical practice.
- 2. Principles of cancer chemotherapy 1 hour *The student should be able to*
 - Describe the basic characteristics and pathophysiology of cancer
 - List the therapeutic goals of Systemic Anti-Cancer Treatment (SACT).
 - List the mechanisms of action of drugs used in SACT with examples.
 - List the adverse effects of SACT.

• Explain the principles underlying combination chemotherapy and development of resistance to SACT.

3. Drugs used in dermatology *The student should be able to*

- Recall the normal structure and functions of the skin.
- Describe the different types of dermatological drug preparations and their clinical indications (e.g.: creams, ointments, lotions, shampoos).
- **4.** Drugs used in disorders of the eye, ear, nose, throat **1** hour *The student should be able to*
 - Describe the mechanism of action, pharmacokinetics, clinical uses, important adverse effects, drug interactions and contraindications of topical drugs used in common eye and ENT conditions.
 - ENT- wax removing agents, nasal sprays, nasal decongestions, topical antibiotics
- Essential drugs, drug regulation & information 1 hour
 The student should be able to
 - Describe the drug regulatory system in Sri Lanka
 - Describe the concept of Essential Medicines, its importance and how it is used
 - Describe the characteristics of the essential drug list, how it is prepared and its limitations
 - List advantages of an Essential Medicines List (EML)
 - Identify differences between essential drug list and hospital formulary list
 - Explain the different components of an AML and the WHO EMLs (both adult and paediatric)
 - Describe the concept of rational use of drugs
 - Describe the importance of standard treatment guidelines on an essential drug list
 - List criteria for rational prescribing
 - Describe the impact of irrational use of drugs
 - Identify different sources of drug information
 - Differentiate unbiased drug information from promotional material
 - Critically analyze the information in a given source of drug information
 - Carry out a literature search on drug information
 - Define over the counter, controlled and prescription only drugs.

6. Pharmacovigilance

1 hour

1 hour

The student should be able to

- Define pharmacovigilance
- Explain the procedure of reporting adverse drug reactions (what to report, who should report, when to report, how to report and where to report)

7. Pharmacoeconomics

1 hour

The student should be able to

- Define pharmacoeconomics
- Define four economic concepts:
 - 1. Opportunity cost
 - 2. Cost effectiveness analysis
 - 3. Cost benefit analysis
 - 4. Cost utility analysis
- Discuss the importance of pharmacoeconomic analysis in decision making in clinical practice

8. Prescription writing

1 hour

The student should be able to

- Define a prescription.
- Describe the format of an outpatient prescription.
- List the standard abbreviations commonly used in prescription writing.
- Comment on the use of generic vs brand names in prescription writing.
- State the rules and regulations governing the prescription of controlled drugs.
- Write a model prescription.
- Describe the basic principles in electronic prescribing.

9. Medication safety & errors

1 hour

Student should be able to

- Differentiate medical error vs medication error
- Explain the various stages in which medication errors occur
- Know some medication errors reported in Sri Lanka
- Describe the factors responsible for medication errors
- Describe methods of preventing medication errors (Swiss cheese model)
- List recommendations to ensure medication safety in Sri Lanka

Total Lecture Hours

19 Hours

Small group discussions:

09 hours

1 hour small group discussions will be held on the following topics:

Tutorials on psychiatric disorders- 05
-Drugs used in dementia management
-Drugs used in addictive disorders
-Antipsychotics
-Drugs used in mood disorders
-Anxiolytics & hypnotics
Tutorials on drugs in Toxicology - 01
Tutorial on haemopoietic agents - 01
Tutorial on miscellaneous conditions - 01
Tutorial on essential drugs, pharmacoeconomics, pharmacovigilance - 01

Therapeutics

General Objective:

To acquire a comprehensive knowledge on numerous medicines that act on the different systems in the body. Both the pharmacological and clinical aspects will be covered here.

Intended Learning Outcomes:

Student should be able to

- Describe the recent developments in appropriate use of medicines in common medical conditions
- Analyze critically the current issues in appropriate use of medicines in common medical conditions
- Evaluate critically the medication use in management of common medical conditions seen in day to day clinical practice
- Communicate in written format the evidence-based critical case discussions related to medication use/ therapeutics in common medical conditions

Contents:

Appropriate use of medicines in the selected conditions including emergency management (where appropriate) and subsequent and long term management.

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