

ER-2020 D. Pharmacy Syllabus – An Overview

The ER-2020 D. Pharmacy Syllabus has the following structure in every course. Though the theory and practical courses are not mutually exclusive, as per the Regulations, the theory and practical are to be considered as individual courses.

Scope: These are broader statements on the purpose of the course in the curriculum, key contents of the course that will contribute to the specific knowledge and or skill developments. The teacher is expected to orient the students about the scope of the particular course at the beginning and intermittently.

Course Objectives: The course objectives describe the key topics that are intended by the teacher to be covered in the course. In general, these are more specific than the scope and broader than the course outcomes. The teacher is expected to discuss the objectives of the course with the students and break-down the course objectives into micro levels as objectives of a specific topic / objectives of a specific lecture, etc. Such an exercise shall make the students to understand the significance of the course / topic / lecture and enhance their attention on the course / topic / lecture.

Course Outcomes: The course outcomes are more specific than the course objectives describe that describe the abilities of the students to perform/act, upon successful completion of the course. Hence, conventionally the course outcomes are described with verbs that are measurable or observable actions. The teacher is expected to describe the desired outcomes of the particular course, so that the students shall understand the various assessment criteria, modalities, and parameters. This also serves as a broader guideline for the teachers for preparing the assessment plan. A well-structured assessment plan associated with the course outcomes shall enable to mapping with the professional competencies and their attainment levels that are attributed to the program outcomes.

Theory Courses: The theory courses basically provide concepts and explain the relationships between the concepts. Understanding of the theoretical courses enable the students to identify the problems in real life situation and make a plan for addressing such problems. Also, the theory course helps to understand what is not known and thus is the tool for accumulation of knowledge. The syllabus of the theory courses has been systematically and logically described as different chapters and the minimum number of hours to be spent on teaching are mentioned chapter wise and course wise. The teachers shall further distribute the total hours of any given chapter among the sub-topics as required by the subject matter.

Practical Courses: The practical courses are designed for applying the theoretical knowledge in the given experimental / simulated conditions. The practical courses deepen the understanding of theories, develop the skills, hone professional competencies, provide opportunities to observe, think and analyse problem solving methods. Further, they help to gain experience with the real things in practice. The teachers shall train the students in actual / simulated practical conditions.

Tutorials: The purpose of the tutorial hour is typically to engage the students in smaller groups in order to pay a closer attention on their learning process. This is an opportunity for the students to complete their assignments, develop specific skills, discuss any problems in the study topics in a less formal way. During the tutorial hour, the students shall exchange their ideas within the small group, and learn to accept constructive criticism and listen to others. Also, the tutorial hour enables the teachers to closely monitor the progress of the individual student and provide additional academic support to individuals, if necessary.

Assignments: The purpose of the assignments are to encourage the students for self- directed learning. Further, the assignments will provoke critical thinking, enhance the skills such as literature search, data mining, data interpretation, report formatting, time-management, and written communication. This is also a mode of self- assessment for the student about the level of understanding of the concepts of a particular course. The teachers shall apply their knowledge and wisdom in choosing the assignment topics at a micro level in alignment with the topics given in the syllabus. The assignments shall be evaluated against a set of criteria. A typical format for the assessment of an assignment is given in Appendix -1.

Field Visits: The purpose of field visits is to provide a real-world experience to the students. The field visits will help them to realize that what they learn within the walls of the classroom / laboratory can help them solve the problems they see in the world around them. Also, this is helpful to the teachers to widen their horizons of knowledge and broadening the scope of the syllabus. Every student shall submit a report describing their objectives, experience, learning points, etc. pertaining to the field trip, in the typical format given in Appendix-2.

Recommended Books: For each course, a list of recommended books is given in the syllabus. The list shall be considered as an important and common resource for the teaching-learning process, but not the complete list. It is always encouraged to use the latest edition of the books specified. Further, the teachers and students are encouraged to explore more primary, secondary, and tertiary resources as required.

Practical Training: The goal of the practical training for the students is to provide a real-time, supervised experience on the professional tasks emphasised in their course of study. Further, it helps them to apply their acquired knowledge and skills in the professional working environment. The practical training intensively prepares the students with adequate competencies and qualifications required for the career opportunity in the future.

Thus, the ER 2020 D. Pharmacy syllabus is designed to nurture the students in all the three domains of Bloom's Taxonomy viz. cognitive (knowledge), affective (attitude) and psychomotor (skills). Further, it also provides ample of scope to the students for different learning styles viz. visual, auditory and kinaesthetic, i.e., 'see, hear and do'.

The summary of the curriculum, courses and other activities and their metrics across the ER-2020 D. Pharmacy program (Part I, II & III) are given here.

Criteria	Metrics
Number of subject areas (considering both theory & practical together)	11
Number of theory courses	11
Number of practical courses	10
Number of theory hours	825
Number of practical hours	600
Number of practical training hours	500
Number of tutorial hours	275
Number of course outcomes for theory courses	45
Number of course outcomes for practical courses	40
Number of courses which have given assignments	9
Number of assignment topics given	75
Number of assignments reports each student shall submit	27
Number of courses which have field visit	5
Number of field visit reports each student shall submit	9
Number of professional competencies	10

Guidelines for the conduct of theory examinations

Sessional Examinations

There shall be two or more periodic sessional (internal assessment) examinations during each academic year. The duration of the sessional exam shall be 90 minutes. The highest aggregate of any two performances shall form the basis of calculating the sessional marks. The scheme of the question paper for theory sessional examinations shall be as given below.

I. Long Answers (Answer 3 out of 4)	$3 \times 5 = 15$
II. Short Answers (Answer 5 out of 6)	$5 \times 3 = 15$
III. Objective type Answers (Answer all 10 out of 10)	$10 \times 1 = 10$
(Multiple Choice Questions / Fill-in the Blanks / One word OR one Sentence questions)	

Total = 40 marks

Internal assessment: The marks secured by the students out of the total 40 shall be reduced to 20 in each sessional, and then the internal assessment shall be calculated based on the best two averages for 20 marks.

Final Board / University Examinations

The scheme of the question paper for the theory examinations conducted by the examining authority (Board / University) shall be as given below. The duration of the final examination shall be 3 hours.

I. Long Answers (Answer 6 out of 7)	$= 6 \times 5 = 30$
II. Short Answers (Answer 10 out of 11)	$= 10 \times 3 = 30$
III. Objective type Answers (Answer all 20)	$= 20 \times 1 = 20$
(Multiple Choice Questions / Fill-in the Blanks / One word OR one Sentence questions)	

Total = 80 marks

Guidelines for the conduct of practical examinations

Sessional Examinations

There shall be two or more periodic sessional (internal assessment) practical examinations during each academic year. The duration of the sessional exam shall be three hours. The highest aggregate of any two performances shall form the basis of calculating the sessional marks. The scheme of the question paper for practical sessional examinations shall be as given below.

I. Synopsis	=	10
II. Experiments	=	50*
III. Viva voce	=	10
IV. Practical Record Maintenance	=	10
Total		= 80 marks

* The marks for the experiments shall be divided into various categories, viz. major experiment, minor experiment, spotters, etc. as per the requirement of the course.

Internal assessment: The marks secured by the students out of the total of 80 shall be reduced to 10 in each sessional, and then the internal assessment shall be calculated based on the best two averages for 10 marks from the sessional and other 10 marks shall be awarded as per the details given below.

Actual performance in the sessional examination	= 10 marks
Assignment marks (Average of three)	= 5 marks*
Field Visit Report marks (Average for the reports)	= 5 marks [§]
Total = 20 marks	

*, [§] Only for the courses given with both assignments and field visit/s

Note:

1. For the courses having either assignments or field visit/s, the assessments of assignments or field visit/s shall be done directly for 10 marks and added to the sessional marks.
2. For the courses not having both assignment and field visit, the whole 20 marks shall be calculated from the sessional marks.

Final Board / University Examinations

The scheme of the question paper for the practical examinations conducted by the examining authority (Board / University) shall be as given below. The duration of the final examination shall be 3 hours.

I. Synopsis	=	10
II. Experiments	=	60*
III. Viva voce	=	10
	Total	= 80 marks

* The marks for the experiments shall be divided into various categories, viz. major experiment, minor experiment, spotters, etc. as per the requirement of the course.

ER-2020 D.Pharm Syllabus – Part I

S. No.	Course Code	Name of the Course	Total Theory / Practical Hours	Total Tutorial Hours	Theory / Practical Hours per Week	Tutorial Hours per Week
1.	ER20-11T	Pharmaceutics – Theory	75	25	3	1
2.	ER20-11P	Pharmaceutics – Practical	75	-	3	-
3.	ER20-12T	Pharmaceutical Chemistry – Theory	75	25	3	1
4.	ER20-12P	Pharmaceutical Chemistry – Practical	75	-	3	-
5.	ER20-13T	Pharmacognosy – Theory	75	25	3	1
6.	ER20-13P	Pharmacognosy – Practical	75	-	3	-
7.	ER20-14T	Human Anatomy & Physiology – Theory	75	25	3	1
8.	ER20-14P	Human Anatomy & Physiology – Practical	75	-	3	-
9.	ER20-15T	Social Pharmacy – Theory	75	25	3	1
10.	ER20-15P	Social Pharmacy – Practical	75	-	3	-

PHARMACEUTICS – THEORY

Course Code: ER20-11T

75 Hours (3 Hours/week)

Scope: This course is designed to impart basic knowledge and skills on the art and science of formulating and dispensing different pharmaceutical dosage forms.

Course Objectives: This course will discuss the following aspects of pharmaceutical dosage forms

1. Basic concepts, types and need
2. Advantages and disadvantages, methods of preparation / formulation
3. Packaging and labelling requirements
4. Basic quality control tests, concepts of quality assurance and good manufacturing practices

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

1. Describe about the different dosage forms and their formulation aspects
2. Explain the advantages, disadvantages, and quality control tests of different dosage forms
3. Discuss the importance of quality assurance and good manufacturing practices

	Mixing: Double cone blender, Turbine mixer, Triple roller mill and Silverson mixer homogenizer	
	Filtration: Theory of filtration, membrane filter and sintered glass filter	
	Drying: working of fluidized bed dryer and process of freeze drying	
	Extraction: Definition, Classification, method, and Applications	
5	Tablets – coated and uncoated, various modified tablets (sustained release, extended-release, fast dissolving, multi-layered, etc.)	8
	Capsules - hard and soft gelatine capsules	4
	Liquid oral preparations - solution, syrup, elixir, emulsion, suspension, dry powder for reconstitution	6
	Topical preparations - ointments, creams, pastes, gels, liniments and lotions, suppositories, and pessaries	8
	Nasal preparations, Ear preparations	2
	Powders and granules - Insufflations, dusting powders, effervescent powders, and effervescent granules	3
	Sterile formulations – Injectables, eye drops and eye Ointments	6
	Immunological products: Sera, vaccines, toxoids, and their manufacturing methods.	4
6	Basic structure, layout, sections, and activities of pharmaceutical manufacturing plants Quality control and quality assurance: Definition and concepts of quality control and quality assurance, current good manufacturing practice (cGMP), Introduction to the concept of calibration and validation	5
7	Novel drug delivery systems: Introduction, Classification with examples, advantages, and challenges	5

PHARMACEUTICS – PRACTICAL

Course Code: ER20-11P

75 Hours (3 Hours/week)

Scope: This course is designed to train the students in formulating and dispensing common pharmaceutical dosage forms.

Course Objectives: This course will discuss and train the following aspects of preparing and dispensing various pharmaceutical dosage forms

1. Calculation of working formula from the official master formula

2. Formulation of dosage forms based on working formula
3. Appropriate Packaging and labelling requirements
4. Methods of basic quality control tests

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

1. Calculate the working formula from the given master formula
2. Formulate the dosage form and dispense in an appropriate container
3. Design the label with the necessary product and patient information
4. Perform the basic quality control tests for the common dosage forms

Practicals

1. Handling and referring the official references: Pharmacopoeias, Formularies, etc. for retrieving formulas, procedures, etc.
2. Formulation of the following dosage forms as per monograph standards and dispensing with appropriate packaging and labelling
 - **Liquid Oral:** Simple syrup, Piperazine citrate elixir, Aqueous Iodine solution
 - **Emulsion:** Castor oil emulsion, Cod liver oil emulsion
 - **Suspension:** Calamine lotion, Magnesium hydroxide mixture
 - **Ointment:** Simple ointment base, Sulphur ointment
 - **Cream:** Cetrimide cream
 - **Gel:** Sodium alginate gel
 - **Liniment:** Turpentine liniment, White liniment BPC
 - **Dry powder:** Effervescent powder granules, Dusting powder
 - **Sterile Injection:** Normal Saline, Calcium gluconate Injection
 - **Hard Gelatine Capsule:** Tetracycline capsules
 - **Tablet:** Paracetamol tablets
3. Formulation of at least five commonly used cosmetic preparations – e.g. cold cream, shampoo, lotion, toothpaste etc
4. Demonstration on various stages of tablet manufacturing processes
5. Appropriate methods of usage and storage of all dosage forms including special dosage such as different types of inhalers, spacers, insulin pens
6. Demonstration of quality control tests and evaluation of common dosage forms viz. tablets, capsules, emulsion, sterile injections as per the monographs

Assignments

The students shall be asked to submit written assignments on the following topics (One assignment per student per sessional period. i.e., a minimum of THREE assignments per student)

1. Various systems of measures commonly used in prescribing, compounding and dispensing practices
2. Market preparations (including Fixed Dose Combinations) of each type of dosage forms, their generic name, minimum three brand names and label contents of the dosage forms mentioned in theory/practical
3. Overview of various machines / equipments / instruments involved in the formulation and quality control of various dosage forms / pharmaceutical formulations.
4. Overview of extemporaneous preparations at community / hospital pharmacy vs. manufacturing of dosage forms at industrial level
5. Basic pharmaceutical calculations: ratios, conversion to percentage fraction, alligation, proof spirit, isotonicity

Field Visit

The students shall be taken for an industrial visit to pharmaceutical industries to witness and understand the various processes of manufacturing of any of the common dosage forms viz. tablets, capsules, liquid orals, injectables, etc. Individual reports from each student on their learning experience from the field visit shall be submitted.

PHARMACEUTICAL CHEMISTRY – THEORY

Course Code: ER20-12T

75 Hours (3 Hours/week)

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

Chapter	Topic	Hours
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 Pharmacopoeial substances, importance of limit test, Principle and procedures of Limit tests for chlorides, sulphates, iron, heavy metals and arsenic.	8
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

3	<p>Inorganic Pharmaceuticals: Pharmaceutical formulations, market preparations, storage conditions and uses of</p> <ul style="list-style-type: none"> ● Haematinics: Ferrous sulphate, Ferrous fumarate, Ferric ammonium citrate, Ferrous ascorbate, Carbonyl iron ● Gastro-intestinal Agents: Antacids :Aluminium hydroxide gel, Magnesium hydroxide, Magaldrate, Sodium bicarbonate, Calcium Carbonate, Acidifying agents, Adsorbents, Protectives, Cathartics ● Topical 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 	7
4	Introduction to nomenclature of organic chemical systems with particular reference to heterocyclic compounds containing up to Three rings	2
<p>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</p>		
5	<p>Drugs Acting on Central Nervous System</p> <ul style="list-style-type: none"> ● 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

6	Drugs Acting on Autonomic Nervous System <ul style="list-style-type: none">• Sympathomimetic Agents: <i>Direct Acting:</i> Nor- Epinephrine*, Epinephrine, Phenylephrine,	9
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	<p>Dopamine*, Terbutaline, Salbutamol (Albuterol), Naphazoline*, Tetrahydrozoline. Indirect Acting Agents: Hydroxy Amphetamine, Pseudoephedrine. Agents With Mixed Mechanism: Ephedrine, Metaraminol</p> <ul style="list-style-type: none"> ● 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 Hydrochloride, Pralidoxime Chloride, Echothiopate Iodide ● Cholinergic Blocking Agents: Atropine Sulphate*, Ipratropium Bromide <p>Synthetic Cholinergic Blocking Agents: Tropicamide, Cyclopentolate Hydrochloride, Clidinium Bromide, Dicyclomine Hydrochloride*</p>	
7	<p>Drugs Acting on Cardiovascular System</p> <ul style="list-style-type: none"> ● Anti-Arrhythmic Drugs: Quinidine Sulphate, Procainamide Hydrochloride, Verapamil, Phenytoin Sodium*, Lidocaine Hydrochloride, Lorcaïnide Hydrochloride, Amiodarone and Sotalol ● Anti-Hypertensive Agents: Propranolol*, Captopril*, Ramipril, Methyldopate Hydrochloride, Clonidine Hydrochloride, Hydralazine Hydrochloride, Nifedipine, ● Antianginal Agents: Isosorbide Dinitrate 	5
8	<p>Diuretics: Acetazolamide, Frusemide*, Bumetanide, Chlorthalidone, Benzthiazide, Metolazone, Xipamide, Spironolactone</p>	2
9	<p>Hypoglycemic Agents: Insulin and Its Preparations, Metformin*, Glibenclamide*, Glimepiride, Pioglitazone, Repaglinide, Gliflozins, Gliptins</p>	3
10	<p>Analgesic And Anti-Inflammatory Agents: Morphine Analogues, Narcotic Antagonists; Nonsteroidal Anti-Inflammatory Agents (NSAIDs) - Aspirin*, Diclofenac, Ibuprofen*, Piroxicam, Celecoxib, Mefenamic Acid, Paracetamol*, Aceclofenac</p>	3

11	Anti-Infective Agents <ul style="list-style-type: none">• Antifungal Agents: Amphotericin-B, Griseofulvin, Miconazole, Ketoconazole*, Itraconazole, Fluconazole*, Naftifine Hydrochloride	8
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	<ul style="list-style-type: none"> ● 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, Sulfamethoxazole, Sulfacetamide*, Mafenide Acetate, Cotrimoxazole, Dapsone* 	
12	Antibiotics: Penicillin G, Amoxicillin*, Cloxacillin, Streptomycin, Tetracyclines: Doxycycline, Minocycline, Macrolides: Erythromycin, Azithromycin, Miscellaneous: Chloramphenicol* Clindamycin	8
13	Anti-Neoplastic Agents: Cyclophosphamide*, Busulfan, Mercaptopurine, Fluorouracil*, Methotrexate, Dactinomycin, Doxorubicin Hydrochloride, Vinblastine Sulphate, Cisplatin*, Dromostanolone Propionate	3

PHARMACEUTICAL CHEMISTRY – PRACTICAL

Course Code: ER20-12P

75 Hours (3 Hours/week)

Scope: This course is designed to impart basic training and hands-on experiences to synthesis chemical substances used as drugs and pharmaceuticals. Also, to perform the quality control tests, impurity testing, test for purity and systematic qualitative analysis of chemical substances used as drugs and pharmaceuticals.

Course Objectives: This course will provide the hands-on experience on the following aspects of chemical substances used as drugs and pharmaceuticals

1. Limit tests and assays of selected chemical substances as per the monograph
2. Volumetric analysis of the chemical substances
3. Basics of preparatory chemistry and their analysis
4. Systematic qualitative analysis for the identification of the chemical drugs

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

1. Perform the limit tests for various inorganic elements and report
2. Prepare standard solutions using the principles of volumetric analysis
3. Test the purity of the selected inorganic and organic compounds against the monograph standards
4. Synthesize the selected chemical substances as per the standard synthetic scheme
5. Perform qualitative tests to systematically identify the unknown chemical substances

Practicals

S. No.	Experiment
1	Limit test for <ul style="list-style-type: none">● Chlorides; sulphate; Iron; heavy metals
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, Potassium Permanganate
4	Assay of the following compounds <ul style="list-style-type: none">● Ferrous sulphate- by redox titration● Calcium gluconate-by complexometric● Sodium chloride-by Modified Volhard's method● Ascorbic acid by iodometry● Ibuprofen by alkalimetry
5	Fundamentals of preparative organic chemistry Determination of Melting point and boiling point of organic compounds
6	Preparation of organic compounds <ul style="list-style-type: none">● Benzoic acid from Benzamide● Picric acid from Phenol
7	Identification and test for purity of pharmaceuticals Aspirin, Caffeine, Paracetamol, Sulfanilamide
8	Systematic Qualitative analysis experiments (4 substances)

Assignments

The students shall be asked to submit the written assignments on the following topics (One assignment per student per sessional period. i.e., a minimum of THREE assignments per student)

1. Different monographs and formularies available and their major contents
2. Significance of quality control and quality assurance in pharmaceutical industries
3. Overview on Green Chemistry
4. Various software programs available for computer aided drug discovery
5. Various instrumentations used for characterization and quantification of drug

PHARMACOGNOSY – THEORY

Course Code: ER20-13T

75 Hours (3 Hours/week)

Scope: This course is designed to impart knowledge on the medicinal uses of various drugs of natural origin. Also, the course emphasizes the fundamental concepts in the evaluation of crude drugs, alternative systems of medicine, nutraceuticals, and herbal cosmetics.

Course Objectives: This course will discuss the following aspects of drug substances derived from natural resources.

1. Occurrence, distribution, isolation, identification tests of common phytoconstituents
2. Therapeutic activity and pharmaceutical applications of various natural drug substances and phytoconstituents
3. Biological source, chemical constituents of selected crude drugs and their therapeutic efficacy in common diseases and ailments
4. Basic concepts in quality control of crude drugs and various system of medicines
5. Applications of herbs in health foods and cosmetics

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

1. Identify the important/common crude drugs of natural origin
2. Describe the uses of herbs in nutraceuticals and cosmeceuticals
3. Discuss the principles of alternative system of medicines
4. Describe the importance of quality control of drugs of natural origin

Chapter	Topic	Hours
1	Definition, history, present status and scope of Pharmacognosy	2
2	Classification of drugs: <ul style="list-style-type: none">● Alphabetical● Taxonomical● Morphological● Pharmacological● Chemical● Chemo-taxonomical	4
3	Quality control of crude drugs: <ul style="list-style-type: none">● Different methods of adulteration of crude drugs● Evaluation of crude drugs	6

4	Brief outline of occurrence, distribution, isolation, identification tests, therapeutic activity and pharmaceutical applications of alkaloids, terpenoids, glycosides, volatile oils, tannins and resins.	6																																						
5	<p>Biological source, chemical constituents and therapeutic efficacy of the following categories of crude drugs.</p> <table border="1" data-bbox="347 488 1295 1742"> <tr> <td data-bbox="347 488 718 533">Laxatives</td> <td data-bbox="718 488 1295 533">Aloe, Castor oil, Ispaghula, Senna</td> </tr> <tr> <td data-bbox="347 533 718 577">Cardiotonic</td> <td data-bbox="718 533 1295 577">Digitalis, Arjuna</td> </tr> <tr> <td data-bbox="347 577 718 701">Carminatives and G.I. regulators</td> <td data-bbox="718 577 1295 701">Coriander, Fennel, Cardamom, Ginger, Clove, Black Pepper, Asafoetida, Nutmeg, Cinnamon</td> </tr> <tr> <td data-bbox="347 701 718 790">Astringents</td> <td data-bbox="718 701 1295 790">Myrobalan, Black Catechu, Pale Catechu</td> </tr> <tr> <td data-bbox="347 790 718 913">Drugs acting on nervous system</td> <td data-bbox="718 790 1295 913">Hyoscyamus, Belladonna, Ephedra, Opium, Tea leaves, Coffee seeds, Coca</td> </tr> <tr> <td data-bbox="347 913 718 958">Anti-hypertensive</td> <td data-bbox="718 913 1295 958">Rauwolfia</td> </tr> <tr> <td data-bbox="347 958 718 1003">Anti-tussive</td> <td data-bbox="718 958 1295 1003">Vasaka, Tolu Balsam</td> </tr> <tr> <td data-bbox="347 1003 718 1048">Anti-rheumatics</td> <td data-bbox="718 1003 1295 1048">Colchicum seed</td> </tr> <tr> <td data-bbox="347 1048 718 1093">Anti-tumour</td> <td data-bbox="718 1048 1295 1093">Vinca, Podophyllum</td> </tr> <tr> <td data-bbox="347 1093 718 1137">Antidiabetics</td> <td data-bbox="718 1093 1295 1137">Pterocarpus, Gymnema</td> </tr> <tr> <td data-bbox="347 1137 718 1182">Diuretics</td> <td data-bbox="718 1137 1295 1182">Gokhru, Punarnava</td> </tr> <tr> <td data-bbox="347 1182 718 1227">Anti-dysenteric</td> <td data-bbox="718 1182 1295 1227">Ipecacuanha</td> </tr> <tr> <td data-bbox="347 1227 718 1317">Antiseptics and disinfectants</td> <td data-bbox="718 1227 1295 1317">Benzoin, Myrrh, Neem, Turmeric</td> </tr> <tr> <td data-bbox="347 1317 718 1361">Antimalarials</td> <td data-bbox="718 1317 1295 1361">Cinchona, Artemisia</td> </tr> <tr> <td data-bbox="347 1361 718 1406">Oxytocic</td> <td data-bbox="718 1361 1295 1406">Ergot</td> </tr> <tr> <td data-bbox="347 1406 718 1451">Vitamins</td> <td data-bbox="718 1406 1295 1451">Cod liver oil, Shark liver oil</td> </tr> <tr> <td data-bbox="347 1451 718 1541">Enzymes</td> <td data-bbox="718 1451 1295 1541">Papaya, Diastase, Pancreatin, Yeast</td> </tr> <tr> <td data-bbox="347 1541 718 1664">Pharmaceutical Aids</td> <td data-bbox="718 1541 1295 1664">Kaolin, Lanolin, Beeswax, Acacia, Tragacanth, Sodium alginate, Agar, Guar gum, Gelatine</td> </tr> <tr> <td data-bbox="347 1664 718 1742">Miscellaneous</td> <td data-bbox="718 1664 1295 1742">Squill, Galls, Ashwagandha, Tulsi, Guggul</td> </tr> </table>	Laxatives	Aloe, Castor oil, Ispaghula, Senna	Cardiotonic	Digitalis, Arjuna	Carminatives and G.I. regulators	Coriander, Fennel, Cardamom, Ginger, Clove, Black Pepper, Asafoetida, Nutmeg, Cinnamon	Astringents	Myrobalan, Black Catechu, Pale Catechu	Drugs acting on nervous system	Hyoscyamus, Belladonna, Ephedra, Opium, Tea leaves, Coffee seeds, Coca	Anti-hypertensive	Rauwolfia	Anti-tussive	Vasaka, Tolu Balsam	Anti-rheumatics	Colchicum seed	Anti-tumour	Vinca, Podophyllum	Antidiabetics	Pterocarpus, Gymnema	Diuretics	Gokhru, Punarnava	Anti-dysenteric	Ipecacuanha	Antiseptics and disinfectants	Benzoin, Myrrh, Neem, Turmeric	Antimalarials	Cinchona, Artemisia	Oxytocic	Ergot	Vitamins	Cod liver oil, Shark liver oil	Enzymes	Papaya, Diastase, Pancreatin, Yeast	Pharmaceutical Aids	Kaolin, Lanolin, Beeswax, Acacia, Tragacanth, Sodium alginate, Agar, Guar gum, Gelatine	Miscellaneous	Squill, Galls, Ashwagandha, Tulsi, Guggul	30
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6	<p>Plant fibres used as surgical dressings: Cotton, silk, wool and regenerated fibres</p> <p>Sutures – Surgical Catgut and Ligatures</p>	3																																						

7	<ul style="list-style-type: none">● Basic principles involved in the traditional systems of medicine like: Ayurveda, Siddha, Unani and Homeopathy● Method of preparation of Ayurvedic formulations like: Arista, Asava, Gutika, Taila, Churna, Lehya and Bhasma	8
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8	Role of medicinal and aromatic plants in national economy and their export potential	2
9	Herbs as health food: Brief introduction and therapeutic applications of: Nutraceuticals, Antioxidants, Pro-biotics, Pre-biotics, Dietary fibres, Omega-3-fatty acids, Spirulina, Carotenoids, Soya and Garlic	4
10	Introduction to herbal formulations	4
11	Herbal cosmetics: Sources, chemical constituents, commercial preparations, therapeutic and cosmetic uses of: Aloe vera gel, Almond oil, Lavender oil, Olive oil, Rosemary oil, Sandal Wood oil	4
12	Phytochemical investigation of drugs	2

PHARMACOGNOSY – PRACTICAL

Course Code: ER20-13P

75 Hours (3 Hours/week)

Scope: This course is designed to train the students in physical identification, morphological characterization, physical and chemical characterization, and evaluation of commonly used herbal drugs.

Course Objectives: This course will provide hands-on experiences to the students in

1. Identification of the crude drugs based on their morphological characteristics
2. Various characteristic anatomical characteristics of the herbal drugs studied through transverse section
3. Physical and chemical tests to evaluate the crude drugs

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

1. Identify the given crude drugs based on the morphological characteristics
2. Take a transverse section of the given crude drugs
3. Describe the anatomical characteristics of the given crude drug under microscopical conditions
4. Carry out the physical and chemical tests to evaluate the given crude drugs

Practicals

1. Morphological Identification of the following drugs:

Ispaghula, Senna, Coriander, Fennel, Cardamom, Ginger, Nutmeg, Black Pepper, Cinnamon, Clove, Ephedra, Rauwolfia, Gokhru, Punarnava, Cinchona, Agar.

2. Gross anatomical studies (Transverse Section) of the following drugs:

Ajwain, Datura, Cinnamon, Cinchona, Coriander, Ashwagandha, Liquorice, Clove, Curcuma, Nux vomica, Vasaka

3. Physical and chemical tests for evaluation of any FIVE of the following drugs:

Asafoetida, Benzoin, Pale catechu, Black catechu, Castor oil, Acacia, Tragacanth, Agar, Guar gum, Gelatine.

Assignments

The students shall be asked to submit the written assignments on the following topics (One assignment per student per sessional period. i.e., a minimum of THREE assignments per student)

1. Market preparations of various dosage forms of Ayurvedic, Unani, Siddha, Homeopathic (Classical and Proprietary), indications, and their labelling requirements
2. Market preparations of various herbal formulations and herbal cosmetics, indications, and their labelling requirements
3. Herb-Drug interactions documented in the literature and their clinical significances

Field Visit

The students shall be taken in groups to a medicinal garden to witness and understand the nature of various medicinal plants discussed in theory and practical courses. Additionally, they shall be taken in groups to the pharmacies of traditional systems of medicines to understand the availability of various dosage forms and their labelling requirements. Individual reports from each student on their learning experience from the field visit shall be submitted.

HUMAN ANATOMY AND PHYSIOLOGY – THEORY

Course Code: ER20-14T

75 Hours (3 Hours/week)

Scope: This course is designed to impart basic knowledge on the structure and functions of the human body. It helps in understanding both homeostasis mechanisms and homeostatic imbalances of various systems of the human body.

Course Objectives: This course will discuss the following: .

1. Structure and functions of the various organ systems and organs of the human body
2. Homeostatic mechanisms and their imbalances in the human body
3. Various vital physiological parameters of the human body and their significances

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

1. Describe the various organ systems of the human body
2. Discuss the anatomical features of the important human organs and tissues
3. Explain the homeostatic mechanisms regulating the normal physiology in the human system
4. Discuss the significance of various vital physiological parameters of the human body

6	Lymphatic system <ul style="list-style-type: none"> ● Lymph and lymphatic system, composition, function and its formation. ● Structure and functions of spleen and lymph node. 	3
7	Cardiovascular system <ul style="list-style-type: none"> ● Anatomy and Physiology of heart ● Blood vessels and circulation (Pulmonary, coronary and systemic circulation) ● Cardiac cycle and Heart sounds, Basics of ECG ● Blood pressure and its regulation 	8
8	Respiratory system <ul style="list-style-type: none"> ● Anatomy of respiratory organs and their functions. ● Regulation, and Mechanism of respiration. ● Respiratory volumes and capacities – definitions 	4
9	Digestive system <ul style="list-style-type: none"> ● Anatomy and Physiology of the GIT ● Anatomy and functions of accessory glands ● Physiology of digestion and absorption 	8
10	Skeletal muscles <ul style="list-style-type: none"> ● Histology ● Physiology of muscle contraction ● Disorder of skeletal muscles 	2
11	Nervous system <ul style="list-style-type: none"> ● Classification of nervous system ● Anatomy and physiology of cerebrum, cerebellum, mid brain ● Function of hypothalamus, medulla oblongata and basal ganglia ● Spinal cord-structure and reflexes ● Names and functions of cranial nerves. ● Anatomy and physiology of sympathetic and parasympathetic nervous system (ANS) 	8
12	Sense organs - Anatomy and physiology of <ul style="list-style-type: none"> ● Eye ● Ear ● Skin ● Tongue ● Nose 	6
13	Urinary system <ul style="list-style-type: none"> ● Anatomy and physiology of urinary system ● Physiology of urine formation ● Renin - angiotensin system ● Clearance tests and micturition 	4

14	Endocrine system (Hormones and their functions) <ul style="list-style-type: none"> ● Pituitary gland ● Adrenal gland ● Thyroid and parathyroid gland ● Pancreas and gonads 	6
15	Reproductive system <ul style="list-style-type: none"> ● Anatomy of male and female reproductive system ● Physiology of menstruation ● Spermatogenesis and Oogenesis ● Pregnancy and parturition 	4

HUMAN ANATOMY AND PHYSIOLOGY – PRACTICAL

Course Code: ER20-14P

75 Hours (3 Hours/week)

Scope: This course is designed to train the students and instil the skills for carrying out basic physiological monitoring of various systems and functions.

Course Objectives: This course will provide hands-on experience in the following:

1. General blood collection techniques and carrying out various haematological assessments and interpreting the results
2. Recording and monitoring the vital physiological parameters in human subjects and the basic interpretations of the results
3. Microscopic examinations of the various tissues permanently mounted in glass slides
4. Discuss the anatomical and physiological characteristics of various organ systems of the body using models, charts, and other teaching aids

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

1. Perform the haematological tests in human subjects and interpret the results
2. Record, monitor and document the vital physiological parameters of human subjects and interpret the results
3. Describe the anatomical features of the important human tissues under the microscopical conditions
4. Discuss the significance of various anatomical and physiological characteristics of the human body

Practicals

1. Study of compound microscope
2. General techniques for the collection of blood
3. Microscopic examination of Epithelial tissue, Cardiac muscle, Smooth muscle, Skeletal muscle, Connective tissue, and Nervous tissue of ready / pre-prepared slides.
4. Study of Human Skeleton-Axial skeleton and appendicular skeleton
5. Determination of
 - a. Blood group
 - b. ESR
 - c. Haemoglobin content of blood
 - d. Bleeding time and Clotting time
6. Determination of WBC count of blood
7. Determination of RBC count of blood
8. Determination of Differential count of blood
9. Recording of Blood Pressure in various postures, different arms, before and after exertion and interpreting the results
10. Recording of Body temperature (using mercury, digital and IR thermometers at various locations), Pulse rate/ Heart rate (at various locations in the body, before and after exertion), Respiratory Rate
11. Recording Pulse Oxygen (before and after exertion)
12. Recording force of air expelled using Peak Flow Meter
13. Measurement of height, weight, and BMI
14. Study of various systems and organs with the help of chart, models, and specimens
 - a) Cardiovascular system
 - b) Respiratory system
 - c) Digestive system
 - d) Urinary system
 - e) Endocrine system
 - f) Reproductive system
 - g) Nervous system
 - h) Eye
 - i) Ear
 - j) Skin

SOCIAL PHARMACY – THEORY

Course Code: ER20-15T

75 Hours (3 Hours/week)

Scope: This course is designed to impart basic knowledge on public health, epidemiology, preventive care, and other social health related concepts. Also, to emphasize the roles of pharmacists in the public health programs.

Course Objectives: This course will discuss about basic concepts of

1. Public health and national health programs
2. Preventive healthcare
3. Food and nutrition related health issues
4. Health education and health promotion
5. General roles and responsibilities of pharmacists in public health

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

1. Discuss about roles of pharmacists in the various national health programs
2. Describe various sources of health hazards and disease preventive measures
3. Discuss the healthcare issues associated with food and nutritional substances
4. Describe the general roles and responsibilities of pharmacists in public health

Chapter	Topic	Hours
1	Introduction to Social Pharmacy <ul style="list-style-type: none">● Definition and Scope. Social Pharmacy as a discipline and its scope in improving the public health. Role of Pharmacists in Public Health. (2)● Concept of Health -WHO Definition, various dimensions, determinants, and health indicators. (3)● National Health Policy – Indian perspective (1)● Public and Private Health System in India, National Health Mission (2)● Introduction to Millennium Development Goals, Sustainable Development Goals, FIP Development Goals (1)	9
2	Preventive healthcare – Role of Pharmacists in the following <ul style="list-style-type: none">● Demography and Family Planning (3)● Mother and child health, importance of breastfeeding, ill effects of infant milk substitutes and bottle feeding (2)● Overview of Vaccines, types of immunity and immunization (4)	18

	<ul style="list-style-type: none"> ● Effect of Environment on Health – Water pollution, importance of safe drinking water, waterborne diseases, air pollution, noise pollution, sewage and solid waste disposal, occupational illnesses, Environmental pollution due to pharmaceuticals (7) ● Psychosocial Pharmacy: Drugs of misuse and abuse – psychotropics, narcotics, alcohol, tobacco products. Social Impact of these habits on social health and productivity and suicidal behaviours (2) 	
3	<p>Nutrition and Health</p> <ul style="list-style-type: none"> ● Basics of nutrition – Macronutrients and Micronutrients (3) ● Importance of water and fibres in diet (1) ● Balanced diet, Malnutrition, nutrition deficiency diseases, ill effects of junk foods, calorific and nutritive values of various foods, fortification of food (3) ● Introduction to food safety, adulteration of foods, effects of artificial ripening, use of pesticides, genetically modified foods (1) ● Dietary supplements, nutraceuticals, food supplements – indications, benefits, Drug-Food Interactions (2) 	10
4	<p>Introduction to Microbiology and common microorganisms (3)</p> <p>Epidemiology: Introduction to epidemiology, and its applications. Understanding of terms such as epidemic, pandemic, endemic, mode of transmission, outbreak, quarantine, isolation, incubation period, contact tracing, morbidity, mortality, . (2)</p> <p>Causative agents, epidemiology and clinical presentations and Role of Pharmacists in educating the public in prevention of the following communicable diseases:</p> <ul style="list-style-type: none"> ● Respiratory infections – chickenpox, measles, rubella, mumps, influenza (including Avian-Flu, H1N1, SARS, MERS, COVID-19), diphtheria, whooping cough, meningococcal meningitis, acute respiratory infections, tuberculosis, Ebola (7) ● Intestinal infections – poliomyelitis, viral hepatitis, cholera, acute diarrheal diseases, typhoid, amebiasis, worm infestations, food poisoning (7) 	28

	<ul style="list-style-type: none"> ● Arthropod-borne infections - dengue, malaria, filariasis and, chikungunya (4) ● Surface infections – trachoma, tetanus, leprosy (2) ● STDs, HIV/AIDS (3) 	
5	Introduction to health systems and all ongoing National Health programs in India, their objectives, functioning, outcome, and the role of pharmacists.	8
6	Pharmacoeconomics – Introduction, basic terminologies, importance of pharmacoeconomics	-2

SOCIAL PHARMACY – PRACTICAL

Course Code: ER20-15P

75 Hours (3 Hours/week)

Scope: This course is designed to provide simulated experience in various public health and social pharmacy activities.

Course Objectives: This course will train the students on various roles of pharmacists in public health and social pharmacy activities in the following areas:

1. National immunization programs
2. Reproductive and child health programs
3. Food and nutrition related health programs
4. Health education and promotion
5. General roles and responsibilities of the pharmacists in public health
6. First Aid for various emergency conditions including basic life support and cardiopulmonary resuscitation

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

1. Describe the roles and responsibilities of pharmacists in various National health programs
2. Design promotional materials for public health awareness
3. Describe various health hazards including microbial sources
4. Advice on preventive measures for various diseases
5. Provide first aid for various emergency conditions

Note: Demonstration / Hands-on experience / preparation of charts / models / promotional materials / role plays / enacting / e-brochures / e-flyers / podcasts / video podcasts / any other innovative activities to understand the concept of various elements of social pharmacy listed here. (At least one activity to be carried out for each one of the following):

Practicals

1. National immunization schedule for children, adult vaccine schedule, Vaccines which are not included in the National Immunization Program.
2. RCH – reproductive and child health – nutritional aspects, relevant national health programmes.
3. Family planning devices
4. Microscopical observation of different microbes (readymade slides)
5. Oral Health and Hygiene
6. Personal hygiene and etiquettes – hand washing techniques, Cough and sneeze etiquettes.
7. Various types of masks, PPE gear, wearing/using them, and disposal.
8. Menstrual hygiene, products used
9. First Aid – Theory, basics, demonstration, hands on training, audio-visuals, and practice, BSL (Basic Life Support) Systems [SCA - Sudden Cardiac Arrest, FBAO - Foreign Body Airway Obstruction, CPR, Defibrillation (using AED) (Includes CPR techniques, First Responder).
10. Emergency treatment for all medical emergency cases viz. snake bite, dog bite, insecticide poisoning, fractures, burns, epilepsy etc.
11. Role of Pharmacist in Disaster Management.
12. Marketed preparations of disinfectants, antiseptics, fumigating agents, antilarval agents, mosquito repellents, etc.
13. Health Communication: Audio / Video podcasts, Images, Power Point Slides, Short Films, etc. in regional language(s) for mass communication / education / Awareness on 5 different communicable diseases, their signs and symptoms, and prevention.
14. Water purification techniques, use of water testing kit, calculation of Content/percentage of KMnO_4 , bleaching powder to be used for wells/tanks
15. Counselling children on junk foods, balanced diets – using Information, Education and Communication (IEC), counselling, etc. (Simulation Experiments).
16. Preparation of various charts on nutrition, sources of various nutrients from Locally available foods, calculation of caloric needs of different groups (e.g. child, mother, sedentary lifestyle, etc.). Chart of glycemic index of foods.
17. Tobacco cessation, counselling, identifying various tobacco containing products through charts/pictures

Assignment

The students shall be asked to submit the written assignments on the following topics (One assignment per student per sessional period. i.e., a minimum of THREE assignments per student)

1. An overview of Women's Health Issues
2. Study the labels of various packed foods to understand their nutritional contents
3. Breastfeeding counselling, guidance – using Information, Education and Communication (IEC)
4. Information about the organizations working on de-addiction services in the region (city / district, etc.)
5. Role of a pharmacist in disaster management – A case study
6. Overview on the National Tuberculosis Elimination Programme (NTEP)
7. Drug disposal systems in the country, at industry level and citizen level
8. Various Prebiotics or Probiotics (dietary and market products)
9. Emergency preparedness: Study of local Government structure with respect to Fire, Police departments, health department
10. Prepare poster/presentation for general public on any one of the Health Days. e.g. Day, AIDS Day, Handwashing Day, ORS day, World Diabetes Day, World Heart Day, etc.
11. List of home medicines, their storage, safe handling, and disposal of unused medicines
12. Responsible Use of Medicines: From Purchase to Disposal
13. Collection of newspaper clips (minimum 5) relevant to any one topic and its submission in an organized form with collective summary based on the news items
14. Read a minimum of one article relevant to any theory topic, from Pharma /Science/ or other Periodicals and prepare summary of it for submission
15. Potential roles of pharmacists in rural India

Field Visits

The students shall be taken in groups to visit any THREE of the following facilities to witness and understand the activities of such centres/facilities from the perspectives of the topics discussed in theory and/or practical courses. Individual reports from each student on their learning experience from the field visits shall be submitted.

1. Garbage Treatment Plant
2. Sewage Treatment Plant
3. Bio-medical Waste Treatment Plant
4. Effluent Treatment Plant
5. Water purification plant
6. Orphanage / Elderly-Care-Home / School and or Hostel/Home for persons with disabilities
7. Primary health care centre

