

**PROPOSED STRUCTURE FOR THEORY & PRACTICAL PAPERS
WITH CONTACT HOURS PER WEEK AND CREDIT POINTS FOR
BACHELOR IN PHARMACEUTICAL TECHNOLOGY DEGREE (B. PHARMACY)**

SEMISTER-I

A. THEORY							
SL. NO.	CODE	THEORY	CONTACTS (PERIODS/WEEK)				CREDITS
			L	T	P	TOTAL	
1	HU 101	HUMANITIES (Professional communication in English)	2	1	-	3	3
2	PT 101	PHARMACEUTICAL ANALYSIS	3	-	-	3	3
3	M 103	REMEDIAL MATHEMATICS	3	-	-	3	3
	PTB 101	REMEDIAL BIOLOGY					
4	PT 103	PHARMACEUTICAL CHEMISTRY (INORGANIC PHARMACEUTICAL CHEMISTRY)	3	1	-	4	4
5	PT 106	PHARMACEUTICS (DISPENSING PHARMACY)	3	-	-	3	3
Total of Theory						16	16
B. PRACTICAL							
1	PT 191	PHARMACEUTICAL ANALYSIS Lab	-	-	3	3	2
2	PT 196	PHARMACEUTICS (DISPENSING PHARMACY) Lab	-	-	3	3	2
3	PT 193	PHARMACEUTICAL CHEMISTRY Lab	-	-	3	3	2
4	PTB 191	REMEDIAL BIOLOGY Lab*	-	-	3	3	2
Total of Practical						12	8
Total of Semester						28	24

* Note: PTB 191 is compulsory for all students

* Practical examination is essential as per PCI norms :

i) Sessional : 40

ii) Practical examination : 60

SEMESTER-II

<u>A. THEORY</u>							
Sl. No.	CODE	THEORY	CONTACTS (PERIODS/WEEK)				CREDITS
			L	T	P	TOTAL	
1	PT 203	PHARMACEUTICAL CHEMISTRY (PHYSICAL CHEMISTRY)	3	1	-	4	4
2	M 203	ADVANCED MATEHMATICS & ENGINEERING MECHANICS	3	1	-	4	4
3	PT 204	PHARMACEUTICAL CHEMISTRY (ORGANIC CHEMISTRY)	3	1	-	4	4
4	HU202	ENVIRONMENT & ECOLOGY	3	-	-	3	3
5	PT 202	PHARMACOGNOSY	2	1	-	3	3
6	PT 205	PHYSIOLOGY	2	1	-	3	3
Total of Theory						21	21
<u>B. PRACTICAL</u>							
1	PT 293	PHARMACEUTICAL CHEMISTRY (PHYSICAL CHEMISTRY) Lab	-	-	3	3	2
2	PT 294	PHARMACEUTICAL CHEMISTRY (ORGANIC CHEMISTRY) Lab	-	-	3	3	2
3	PT 292	PHARMACOGNOSY Lab	-	-	3	3	2
4	PT 295	PHYSIOLOGY Lab	-	-	3	3	2
Total of Practical						12	8
Total of Semester						33	29

SEMESTER-III

<u>A. THEORY</u>							
Sl. No.	CODE	THEORY	CONTACTS (PERIODS/WEEK)				CREDITS
			L	T	P	TOTAL	
1	PT 304	PHARMACEUTICAL CHEMISTRY (ORGANIC CHEMISTRY)	3	1	-	4	4
2	PT 301	PHARMACEUTICAL ANALYSIS	3	1	-	4	4
3	PT 306	PHARMACEUTICS (PHYSICAL PHARMACY)	3	1	-	4	4
4	PT 307	PHARMACEUTICAL ENGINEERING	3	1	-	4	4
5	CS 303	BASIC ELECTRONICS & COMPUTER APPLICATION	3	1	-	4	4
6	PT-305	Anatomy, Physiology & Health Education (APHE)	3	-	-	3	3
Total of Theory						23	23
<u>B. PRACTICAL</u>							
1	PT 394	PHARMACEUTICAL CHEMISTRY (ORGANIC CHEMISTRY) Lab	-	-	3	3	2
2	PT 391	PHARMACEUTICAL ANALYSIS	-	-	3	3	2
3	PT 396	PHARMACEUTICS (PHYSICAL PHARMACY) Lab	-	-	3	3	2
4	PT 397	ENGINEERING DRAWING Lab	-	-	3	3	2
5	CS 393	BASIC ELECTRONICS & COMPUTER APPLICATION Lab	-	-	3	3	2
Total of Practical						15	10
Total of Semester						38	33

SEMESTER-IV

<u>A. THEORY</u>							
Sl. No.	CODE	THEORY	CONTACTS (PERIODS/WEEK)				CREDITS
			L	T	P	TOTAL	
1	PT 406	PHARMACEUTICS (PHARMACEUTICAL TECHNOLOGY-I)	3	1	-	4	4
2	PT 402	PHARMACOGNOSY	3	1	-	4	4
3	PT 404	PHARMACEUTICAL CHEMISTRY (BIO-CHEMISTRY)	3	1	-	4	4
4	PT 405	PHYSIOLOGY	3	1	-	4	4
5	PT 407	PHARMACEUTICAL ENGINEERING	3	1	-	4	4
Total of Theory						20	20
<u>B. PRACTICAL</u>							
1	PT 496	PHARMACEUTICS (PHARMACEUTICAL TECHNOLOGY-I) LAB	-	-	3	3	2
2	PT 492	PHARMACOGNOSY Lab	-	-	3	3	2
3	PT 497	PHARMACEUTICAL ENGINEERING LAB	-	-	3	3	2
4	PT 494	PHARMACEUTICAL CHEMISTRY (BIO-CHEMISTRY) LAB	-	-	3	3	2
Total of Practical						12	8
Total of Semester						32	28

SEMESTER-V

<u>A. THEORY</u>							
Sl. No.	CODE	THEORY	CONTACTS (PERIODS/WEEK)				CREDITS
			L	T	P	TOTAL	
1	PT 506	PHARMACEUTICS (PHARMACEUTICAL TECHNOLOGY-II)	3	1	-	4	4
2	PT 508	PHARMACOLOGY	3	-	-	3	3
3	PT 509	PHARMACEUTICAL MICRO-BIOLOGY	3	-	-	3	3
4	PT 503	PHARMACEUTICAL CHEMISTRY (MEDICINAL CHEMISTRY)	3	1	-	4	4
5	PT 507	PHARMACEUTICAL ENGINEERING	3	-	-	3	3
6.	PT 504	PHARMACEUTICAL CHEMISTRY (BIO-CHEMISTRY)	3	-	-	3	3
Total of Theory						20	20
<u>B. PRACTICAL</u>							
1	PT 596	PHARMACEUTICS (PHARMACEUTICAL TECHNOLOGY-II) LAB	-	-	3	3	2
2	PT 597	PHARMACEUTICAL ENGINEERING LAB	-	-	3	3	2
3	PT 599	PHARMACEUTICAL MICRO-BIOLOGY LAB	-	-	3	3	2
4	PT 593	PHARMACEUTICAL CHEMISTRY (MEDICINAL CHEMISTRY) LAB	-	-	3	3	2
Total of Practical						12	08
Total of Semester						32	28

SEMESTER-VI

<u>A. THEORY</u>							
Sl. No.	CODE	THEORY	CONTACTS (PERIODS/WEEK)				CREDITS
			L	T	P	TOTAL	
1	PT 603	PHARMACEUTICAL CHEMISTRY (MEDICINAL CHEMISTRY)	3	1	-	4	4
2	PT 606	PHARMACEUTICS (PHARMACEUTICAL TECHNOLOGY)	3	-	-	3	3
3	PT 611	PHARMACEUTICS (BIO-PHARMACEUTICS & PHARMACOKINETICS)	3	1	-	4	4
4	PT 608	PHARMACOLOGY	3	-	-	3	3
5	PT 609	PHARMACEUTICAL BIO-TECHNOLOGY & INDUSTRIAL MICRO-BIOLOGY	3	-	-	3	3
6.	PT 610A/B	ELECTIVE-I	3	-	-	3	3
Total of Theory						20	20
<u>B. PRACTICAL</u>							
1	PT 693	PHARMACEUTICAL CHEMISTRY (MEDICINAL CHEMISTRY) LAB	-	-	3	3	2
2	PT 696	PHARMACEUTICS (PHARMACEUTICAL TECHNOLOGY) LAB	-	-	3	3	2
3	PT 697	PHARMACEUTICS (BIO-PHARMACEUTICS & PHARMACOKINETICS) LAB	--	-	3	3	2
4	PT 698	PHARMACOLOGY LAB	-	-	3	3	2
5	PT 691A/B	ELECTIVE-I					
Total of Practical						12	8
<u>C. SESSIONALS</u>							
Seminar (PT 682)			3		2		
Total of Semester			35		30		

Elective-I

PT610A/691A: Computer application in Pharmaceutical Technology and in Clinical Pharmacy.

PT610B/691B: Advanced Pharmaceutical Biotechnology.

SEMESTER-VII

<u>A. THEORY</u>							
Sl. No.	CODE	THEORY	CONTACTS (PERIODS/WEEK)				CREDITS
			L	T	P	TOTAL	
1	PT 706	PHARMACEUTICS (PHARMACEUTICAL TECHNOLOGY)	3	-	-	3	3
2	PT 703	PHARMACEUTICAL CHEMISTRY (MEDICINAL CHEMISTRY)	3	-	-	3	3
3	PT 702	PHARMACOGNOSY	3	-	-	3	3
4	PT 708	PHARMACOLOGY	3	-	-	3	3
5	PT 709A/B/C	ELECTIVE-II	3	-	-	3	3
Total of Theory						15	15
<u>B. PRACTICAL</u>							
1	PT 796	PHARMACEUTICS (PHARMACEUTICAL TECHNOLOGY) LAB	-	-	3	3	2
2	PT 793	PHARMACEUTICAL CHEMISTRY (MEDICINAL CHEMISTRY) LAB	-	-	3	3	2
3	PT 783	PROJECT	-	-	8	8	6
Total of Practical						14	10
<u>C. SESSIONALS</u>							
1	Seminar on assigned topic (PT 782)		3			2	
	Total of sessionals		3			2	
Total of Semester			32			27	

Elective-

PT709A: Packaging Technology

PT709B: Advanced Pharmacognosy.

PT709C: Pharmaceutical Marketing Management.

SEMESTER-VIII

<u>A. THEORY</u>							
Sl. No.	CODE	THEORY	CONTACTS (PERIODS/WEEK)				CREDITS
			L	T	P	TOTAL	
1	PT 812	PHARMACEUTICAL INDUSTRIAL MANAGEMENT	3	-	-	3	3
2	PT 813	PHARMACEUTICAL JURISPRUDENCE & ETHICS	3	-	-	3	3
3	PT 818	HOSPITAL PHARMACY & CLINICAL PHARMACY	3	-	-	3	3
4	PT 801	PHARMACEUTICAL ANALYSIS	3	-	-	3	3
Total of Theory						12	12
<u>B. PRACTICAL</u>							
1	PT 891	PHARMACEUTICAL ANALYSIS	-	-	3	3	2
			-	-	-	-	-
Total of Practical						03	02
<u>C. Sessional</u>							
1	PT 884	VIVA-VOCE	-	-	-	06	06
			-	-			
Total of Sessional						06	06
Total of Semester						21	20

PRECIES OF TOTAL GRADES IN B. PHARMACY PROGRAMME

SEMESTER	MINIMUM	MAXIMUM
SEM I		24
SEM II		29
SEM III		33
SEM IV		28
SEM V		28
SEM VI		30
SEM VII		27
SEM VIII		20
TOTAL CREDIT		219

Professional communication in English

Theory

Code : HU 101

Contact : 2L + I T = 3

Credits: 3

Prerequisites:

The student must have some basic command of English that is he/she must be able to write grammatically correct English, understand (if not use) at least some 2500 general purpose words of English to express himself in writing and 1500 words to talk about day-to-day events and experiences of life, understand slowly-delivered spoken material in Standard Indian English , and speak reasonably clearly (if not fluently) on routine matters with his fellow students.

Course outcome:

To help the students to develop some key concepts like context of communication, writing, reading comprehension, speaking, group discussion, telephonic conversations and language comprehension.

Contents of the syllabus:

- Grammar – Structure of sentences – Active / Passive Voice – Direct / Indirect Narration
- Essay – Descriptive – Comparative – Argumentative – Thesis statement- Structure of opening / concluding paragraphs – Body of the essay
- Reading Comprehension – Global – Contextual – Inferential – Select passages from recommended text
- Business Correspondence – Letter Writing – Formal. Drafting. Biodata- Resume- Curriculum Vitae
- Report Writing – Structure , Types of report – Practice Writing
- Communication / Public Speaking skills , Features of effective speech, verbal-nonverbal Group discussion – principle – practice

Reference books:

1. Mark McCormack : “Communication”
2. John Mettchell “ How to write reports”
3. L. Gartside , “Model Business Letters” , Pitman.
4. Longman , “Longman Dictionary of Contemporary English” (or ‘Oxford Advanced Learner’s Dictionary of Current English, OUP.
5. Maxwell Nurnberg and Rosenblum Morris , “All About Words” , General Book Depot.

Pharmaceutical Analysis

Theory

Code : PT 101

Contacts: 3

Credits : 3

Prerequisites:

The student must have some basic knowledge of stoichiometry and titrimetric analysis. He/she also should have basic knowledge of handling of chemicals.

Course outcome:

To help the students to develop some key concepts on different forms of quantitative analysis, sampling, statistical handling of data and make them ready to work in the industry analytical labs and also fuel their inquisitiveness.

Syllabus Content:

1. Significance of quantitative analysis in quality control, Different techniques of analysis, Preliminaries and definitions, Significant figures, Rules for retaining significant digits, Types of errors, Mean deviation, Standard deviation, Statistical treatment of small data sets, Selection of sample, Precision and accuracy, Fundamentals of volumetric analysis, methods of expressing concentration, primary and secondary standards.
2. Acid Base Titrations : Acid base concept, Selection of solvents, strengths of acids and bases, Ionization, Law of mass action, Common Ion effect, Ionic product of water, pH, Hydrolysis of salts, Henderson-Hasselbach equation, Buffer solutions, Neutralization curves, Acid-base indicators. Theory of indicators, Choice of indicators, Mixed indicators, Polyprotic system, Polyamine and amino acid systems,
3. Precipitation Titrations : Precipitation reactions, Solubility products, Effect of acids, temperature and solvent upon the solubility of a precipitate, Argentometric titrations and titrations involving ammonium or potassium thiocyanate, mercuric nitrate, and barium sulphate, Indicators, Gay-Lussac method, Mohr's method, Volhard's method and Fajan's method.
4. Oxidation Reduction Titration: Concepts of oxidation and reduction, Redox reactions, Strengths and equivalent weights of oxidising and reducing agents. Theory of redox titration, Redox indicators, Cell representations, Measurement of electrode potential, oxidation-reduction curves, Iodometry and Iodimetric Titrations involving ceric sulphate, potassium iodate, potassium bromate, potassium permanganate
5. Gravimetric analysis: Precipitation techniques, Solubility products, The colloidal state, supersaturation co-precipitation, Post-precipitation, Washing of the precipitate, Filtration, Filter papers and crucibles, Ignition, Thermogravimetric curves, Specific examples like barium sulphate, aluminium as aluminium oxide, calcium as calcium oxalate and magnesium as magnesium sulphate.

Reference:

1. Vogel's textbook of quantitative chemical analysis. Edited by JH Jeffery, J Basset, J Mendham, RC Denny. 5th edition.
2. Practical pharmaceutical chemistry: Part 1, Edited and authored by A. H. Beckett and B Stanlake

Pharmaceutical Analysis

Practical

Code: PT 191
Contacts: 3
Credits: 2

Prerequisites:

The student must have some basic knowledge of handling of glasswares and titrimetric analysis. He/she also should have basic knowledge of handling of chemicals.

Course outcome:

The students are introduced to the main analytical tools through demonstrations. They pertain a clear understanding of a typical analytical balance, the requirements of a good balance, weights, care and use of balance, methods of weighing and errors in weighing. The students are familiarised with the general apparatus and titrimetric procedures required in various levels of pharmacy

Course content:

1. Standardization of analytical weights and calibration of volumetric apparatus.
2. Acid base Titration: Preparation and standardization of acids and bases, some exercises related with determination of acids and bases separately or in mixture form , some official assay procedures e.g. boric acid should also be covered.
3. Oxidation Reduction Titrations: Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate, etc. some exercises related to determination of oxidizing and reducing agents in the sample shall be covered.
4. Precipitation titrations: Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, Titrations according to Volhard's and Fajan's method.
5. Gravimetric analysis: One exercise related to gravimetric analysis is to be covered.

Reference:

1. Vogel's textbook of quantitative chemical analysis. Edited by JH Jeffery, J Basset, J Mendham, RC Denny. 5th edition.
2. Practical pharmaceutical chemistry: Part 1, Edited and authored by A. H. Beckett and B Stanlake

Pharmaceutical Chemistry (Inorganic Pharmaceutical Chemistry)

Theory

Code: PT 103

Contacts: 3L+1T

Credits: 4

Prerequisites:

The student must have some basic knowledge of chemical properties of inorganic chemicals. He/she should also have clear knowledge of elements, radicals, functional groups and acid base theory.

Outcome:

The students will be well acquainted with the principle of limit tests, different classes of inorganic pharmaceuticals and their assay procedure.

Syllabus content:

An outline of methods of preparation, uses, sources of impurities, tests for purity and identity, including limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate and special tests if any, of the following classes of inorganic pharmaceuticals included in Indian Pharmacopoeia.

1. Acids and Bases: Buffers :, Arrhenius concept, Lewis concept, Bronsted Lowry concept, pH, pOH, Buffer solutions, buffer capacity, physiological buffer, selection of buffer solution and role of buffer in pharmacy, Water (Types, quality, purification and preservation)
2. Gastrointestinal Agents: Acidifying agents (dilute hydrochloric acid), Antacids [definition, characteristics, drug interaction, compounds including aluminium hydroxide gel, dried aluminium hydroxide gel, calcium carbonate, magnesium carbonate (light & heavy), milk of magnesia, magnesium trisilicate and sodium bi-carbonate injection] Protectives and Adsorbents (mismatch sub-carbonate and bismath subgalate), Cathartics (definition and Mechanism of action of cathartics, laxatives and purgatives, Magnesium sulphate and disodium hydrogen phosphate)
3. Major Intra-and Extra-cellular electrolytes: Physiological ions, Electrolytes used for replacement therapy, acid-base balance and combination therapy.
4. Essential and Trace Elements: Transition elements and their compounds of pharmaceutical importance: Iron and haematinics, mineral supplements.
5. Cationic and anionic components of inorganic drugs useful for systemic effects.
6. Inorganic Radio pharmaceuticals: Nuclear radio pharmaceuticals. clinical applications and dosage, hazards and precautions.
7. Topical Agents: Protectives (silicon polymers, activated dimethicone, calamine & calamine lotion, zinc oxide) , Astringents and Anti-infectives(Hydrogen peroxide, potassium permanganate, chlorinated lime, iodine solutions, sublime sulphur)
8. Dental Products: Dentifrices, Anti-caries agents
9. Complexing and chelating agents used in therapy
10. Miscellaneous Agents: Definition and representative example of Sclerosing agents, expectorants, emetics, poisons and antidotes, sedatives etc. Pharmaceutical Aids used in Pharmaceutical Industry. Anti-oxidants, preservatives, filter aids, adsorbents, diluents, excipients, suspending agents, colorants etc.

Reference books:

1. Pharmaceutical chemistry - inorganic, Vol. 1. G.R. Chatwal, S.K. Anand.

Pharmaceutical Chemistry (Inorganic Pharmaceutical Chemistry)

Practical

Code: PT 193

Contacts: 3

Credits: 2

Prerequisites:

He/she should have basic knowledge of handling of chemicals, elemental analysis.

Outcome:

The practical paper deals with identification of different anions, cations and different inorganic pharmaceuticals.

Syllabus Content:

The background and systematic qualitative analysis of inorganic mixtures of upto four radicals, Six Mixtures to be analysed, preferably by semi-micro methods, identification tests for pharmaceutical/inorganic pharmaceuticals and qualitative tests for cations and anions should be covered

Reference book:

1. Textbook of pharmaceutical chemistry (inorganic), M. Ali

Remedial Mathematics

Theory (Elective)

Code: M 103
Contacts: 3L + IT Credits: 3

Prerequisites:

The student basic knowledge in mathematics.

Outcome:

The students will be able to use the knowledge obtained, in further fields of pharmacy like pharmaceutical engineering.

Syllabus content:

1. Algebra: Determinants of order 2,3, properties, simple problems, solution of simultaneous equations by Cramer's rule, matrices, special types of matrices, arithmetic operations on matrices, inverse of a matrix, solution of simultaneous equations by matrices, inversion method, pharmaceutical applications of determinants and matrices.
2. Calculus:
Differential: Limits, continuity of functions of a single variable derivatives, successive derivatives, Leibnitz theorem (statement only) simple problems, Lagrange's Mean Value Theorem, simple problems, evaluation of limits by L' Hospital's rule (Indeterminate form). Partial differentiation for functions of two variables, Euler's theorem on homogeneous functions of two variables (statement, no proof) Maxima and minima for functions of a single variable, simple problems.
3. Calculus :
Integral: Indefinite integrals of standard forms, integration by parts, method of substitution, partial fractions, formal evaluation of definite integrals.
4. Differential Equations: Definition and formation of differential equations, order and degree, equations of first order and first degree, variable separable, homogeneous, exact and linear differential equations and equations reducible to such types, linear differential equations of order greater than one with constant coefficients, complementary function and particular integral, pharmaceutical applications.

Reference books:

1. Engineering mathematics. B.K Pal

Remedial Biology

Theory (Elective)

Code: PTB 101

Contacts: 3

Credits: 3

Prerequisites:

Basic preliminary knowledge of chemistry and biology are required.

Outcome:

The students will be able to use the knowledge obtained, in further fields of pharmacy like pharmacognosy, physiology and pharmacology.

Syllabus Content:

1. General idea about classification of plants, rules of priority, ICBN, brief idea about natural sexual and phyllogenetic system and classification, their merits & demerits. binomial nomenclature, taxa and taxon
2. Plant Cell : It's structure and non-living inclusions, mitosis and meiosis, different types of plant tissues and their structure, location and function.
3. Morphology and histology of root, stem, bark, wood, leaf, inflorescence flower, fruit and seed, Modification of root and stem.
4. General Survey of animal kingdom, Structure and life history & pathogenecity of parasites as illustrated by amoeba, entamoeba, trypanosoma, plasmodium, taenia, ascaris, schistosom, oxyuris, and ancylostoma.
5. General Structure and life history of insects like mosquito, housefly, mites (sarcoptes scabies) and silkworm.

Reference Books:

1. College Botany: S.C. Santra
2. College Botany: H.C. Ganguly

Remedial Biology

Practical

Code: PTB 191
Contacts: 3
Credits: 2

Prerequisite: The students are required to have a basic knowledge of botany practical.

Outcome:

The students will be able to use the knowledge obtained, in further fields of pharmacy like pharmacognosy, physiology and pharmacology.

Syllabus content:

1. Morphology of plant parts indicated in theory.
2. Care, use and type of microscopes.
3. Gross identification of slides of structure and life cycle of lower plants, animals mentioned in theory.
4. Morphology of plant parts indicated in theory.
5. Preparation, microscopic examination of stem, root and leaf of monocot and dicot plants.
6. Dissection of toads and identification of different organs.

Reference Books:

1. College Botany: S.C. Santra
2. College Botany: H.C. Ganguly

Pharmaceutics (Dispensing Pharmacy)

Theory

Code : PT 106

Contact : 2L + I T = 3

Credits: 3

Prerequisites:

The student must have some basic knowledge of essential mathematics, concepts and skills to calculate numericals using the formula, ratio, and dimensional analysis methods. They must have the knowledge of science.

Course outcome:

Learn about different types of pharmaceutical formulations and preparation and dispensing of them.

Dispense the prescription falling under the categories : Mixture, solutions, emulsions, ointments, powders, suppositories, ophthalmics, paste, paints, tablet triturates, lotions, liniments, etc.

Identify the various types of incompatibilities in prescription, correction thereof and dispense the prescriptions.

Contents of the syllabus:

- Introduction to pharmacopoeia and different types of pharmaceutical formulations (definition).
- Prescription : Handling of prescription, source of errors in prescription, care required in dispensing procedures including labelling of dispensed products.
- General dispensing procedures including labelling of dispensing products.
- Pharmaceutical calculations : Posology, calculation of doses for infants, adults and elderly patients; calculation involving percentage solution, allegation method, alcohol dilution, proof spirit, isotonicity adjustment.
- Principles involved and procedures adopted in dispensing of : Typical prescriptions like solution, emulsions, ointments, powders, pills, tablet triturates etc.
- Incompatibilities : Physical, chemical and therapeutic incompatibilities. Correction of incompatibilities.
- Community Pharmacy : Organisation and structure of retail and whole sale drug store-types of drug store and design, legal requirement for establishment, maintenance and drug store-dispensing
- of proprietary products, maintenance of records of retail and wholesale, patient counselling, role of pharmacist in community health care and education.

Reference books:

1. Cooper & Gunn's dispensing for pharmaceutical students Revised by Carter, S. J.
2. The Pharmaceutical Codex: Principles and Practice of Pharmaceutics Edited By Walter Lund
3. Indian Pharmacopoeia 2007, Vol. 1
4. Indian Pharmacopoeia 2007, Vol. 2
5. Indian Pharmacopoeia 2007, Vol. 3

Pharmaceutics (Dispensing Pharmacy)

Practical

Code: PT 196
Contacts: 3
Credits: 2

Prerequisites:

The student must have some basic knowledge of essential mathematics, concepts and skills to calculate numericals using the formula, ratio, and dimensional analysis methods. They must have the knowledge of basic science.

Course outcome:

Dispense the prescription falling under the categories : Mixture, solutions, emulsions, ointments, powders, suppositories, ophthalmics, paste, paints, tablet titurates, lotions, liniments, etc.

Identify the various types of incompatibilities in prescription, correction thereof and dispense the prescriptions.

Contents of the syllabus:

1. Dispensing of prescription falling under the categories : Mixture, solutions, emulsions, ointments, powders, suppositories, ophthalmics, paste, paints, tablet titurates, lotions, liniments, etc.
2. Identification of various types of incompatibilities in prescription, correction thereof and dispensing of such prescriptions.

Reference books:

1. Cooper & Gunn's dispensing for pharmaceutical students Revised by Carter, S. J.
2. The Pharmaceutical Codex: Principles and Practice of Pharmaceutics Edited By Walter Lund
3. Indian Pharmacopoeia 2007, Vol. 1
4. Indian Pharmacopoeia 2007, Vol. 2
5. Indian Pharmacopoeia 2007, Vol. 3

Pharmaceutical Chemistry (Physical Chemistry)

Theory

Code: PT 203

Contacts: 3L+1T

Credits: 4

Prerequisites:

The student should have clear understanding about the significance of physico-chemical and thermodynamic properties of chemical substances.

Outcome:

The students will be able to use the knowledge obtained on various states of gases, liquids; colloids, thermodynamics etc in the ensuing fields like pharmaceutical engineering, physical pharmacy and medicinal chemistry.

Syllabus Content:

1. Behaviour of Gases: Kinetic theory of gases, deviation from ideal behaviours and explanation.
2. The Liquid State: Physical properties (surface tension, parachor, viscosity, refractive index, optical rotation, dipole moments and chemical constituents).
3. Solutions: Ideal and real solutions, solutions of gases in liquids, colligative properties, partition coefficient, conductance and its measurement, Debye Huckel theory.
4. Colloids
5. Acids, bases and salts, pH, pka, buffers and buffering action.
6. Thermodynamics: First law of thermodynamics : Energy, Work, Heat, Enthalpy, Thermochemistry.

Second law of Thermodynamics : Entropy, Free Energy Net Work, deduction of important equations Clausius-calpeyron equation Helomrholtz equation, Vant Hoff equation.

Phase equilibria and phase rule.

7. Adsorption : Freudlich and Gibbs adsorption isotherms, Langmuir theory of adsorption.
8. Chemical Kinetics: Molecularity and order of reaction, Zero, first and second order reactions, complex reactions, theories of reaction kinetics, Arrhenius equation, characteristics of homogeneous and heterogeneous catalysis, acid-base and enzyme catalysis.
9. Electrochemistry: electrolyte and non-electrolytes

Reference books:

1. Atkins' physical chemistry. Peter Atkins
2. Physical Chemistry. P.C. Rakshit

Pharmaceutical Chemistry (Physical Chemistry)

Practical

Code: PT 293

Contacts: 3

Credits: 2

Prerequisites:

He/she should have basic expertise in chemical handling, weighing and instrument handling. Also they should have basic knowledge of the physicochemical properties of compounds.

Outcome:

The students will be able to use the knowledge obtained on various states of gases, liquids; colloids, thermodynamics etc in the ensuing fields like pharmaceutical engineering, physical pharmacy and medicinal chemistry.

Syllabus Content:

1. To determine the refractive index of given liquids
2. To determine the specific rotation of sucrose at various concentration and determine the intrinsic rotation.
3. To determine the rate constant of simple reaction
4. Determination of partition co-efficient of drugs
5. Experiments on adsorption and colorimetry
6. Determination of transition temperature of a salt.
7. Determination of adsorption coefficient.
8. Determination of surface tension and viscosity of liquids
9. Determination of acid-base, dissociation constant by pH meter

Reference Books:

1. Atkins' physical chemistry. Peter Atkins
2. Physical Chemistry. P.C. Rakshit

Advanced mathematics & Engineering Mechanics

Theory

Code: M 203

Contacts: 3L + 1T

Credits: 4

Prerequisites:

The student must have an analytical mind and should be able to process data as required.

Outcomes:

The knowledge acquired in this subject will be useful in ensuing fields like pharmaceutical engineering and pharmaceutical analysis.

Syllabus content:

1. Biometrics : Exact and approximate numbers, significant digits and rounding off numbers, data collection, data organisation, diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams, simple measures of central tendency, mean, median, mode, simple measure of dispersion, standard Deviation and standard error of means, coefficient of variation, concept of probability, classical and frequency definition of probability, conditional and compound probability, independence of events, total, addition and multiplication theorems of probability (no proof required), simple problems of probability, Bayes Theorem (statement) and application, elements of Binomial and Poisson distributions, Normal distribution curve and properties, Kurtosis and skewness, correlation and regression lines, linear curve fitting by the method of least squares, confidence (fiducial) limits, statistical reference, Student's and paired t-test and F-test, applications of statistical concepts in Pharmaceutical Sciences.
2. Laplace Transforms : Definition, transforms of elementary functions, properties of linearity and shifting, inverse Laplace transforms, transforms of derivatives, solution of ordinary simultaneous differential equations (in two variables).
3. Engineering Mechanics : Composition and resolution of forces, equilibrium of concurrent forces, Polygon of forces, Friction, Sliding friction (simple problems) Centre of gravity arc, area, volume (use of calculus) simple problems, Motion under gravity, work, power, energy, conservation of Energy.

Reference Books:

- 1 . Numerical Methods in Science and Engineering . B. S. Grewal.
2. An introduction to statistical methods. C. B. Gupta

Pharmaceutical Chemistry (Organic Chemistry)

Theory

Code: PT 204

Contacts: 3L+1T

Credits: 4

Prerequisites:

The student should have a basic knowledge of atomic structure, classification and properties of organic compounds.

Outcome:

The knowledge obtained from this subject will be helpful in further studies in subjects like organic chemistry, biochemistry and medicinal chemistry.

Syllabus content:

1. The subject of organic chemistry will be treated in its modern perspective keeping for the sake of conveniences, the usual classification of organic compounds :
2. Structure and Properties : Atomic structure, Atomic orbitals. Molecular orbital theory, Molecular orbitals, Bonding and Antibonding orbitals, Covalent bond, Hybrid orbitals, Intramolecular forces, Bond dissociation energy, Polarity of bonds, Polarity of molecules, structure and physical properties, Intermolecular forces.
3. Structure, Nomenclature, Preparation and Reactions of Alkanes, Alkenes, Alkynes, Cycloalkanes, Dienes, alkyl halides.
4. Stereochemistry: Isomerism and nomenclature and associated physicochemical properties, optical activity, stereoisomerism, specification of configuration, Reactions involving stereoisomers, chirality, chiral reagents conformations.
5. Structure, Nomenclature, Preparation and Reactions of: Alcohols, Ethers, Epoxides, Amines, Aldehydes and ketones, Carboxylic acids.
6. Concept of Aromaticity.

Reference Books:

1. Organic Chemistry . R.T. Morrison
2. Organic Chemistry. I.L. Finar. Volume 1.
3. A guidebook of mechanism in organic chemistry. Peter Sykes
4. Stereochemistry of organic compounds. E.L. Eliel

Pharmaceutical Chemistry (Organic Chemistry)

Practical

Code: PT 294
Contacts: 3
Credits: 2

Prerequisites:

Successful completion of all Semester 1 courses of B. Pharm as per WBUT syllabus. The student should have a basic knowledge of chemical and physical properties of organic compounds having specific functional groups. They should have a theoretical knowledge of stereochemistry.

Outcome:

The knowledge obtained from this subject will be helpful in further studies in subjects like organic chemistry, biochemistry and medicinal chemistry.

Syllabus Content:

1. The students should be introduced to the various laboratory techniques, through demonstrations involving synthesis of selected organic compounds (e.g. aspirin, p-bromoacetanilide, reduction of nitrobenzene etc.)
2. Identification of organic compounds and their derivatisation.
3. Introduction to the use of stereomodels.

Reference Books:

1. Vogel's textbook of practical organic chemistry. Edited by B. S. Furniss.

Environment and Ecology

Theory

Code: HU-202

Contact: 3L+ 1T =4

Credits: 3

General

Prerequisites: The students should have a basic knowledge about our environment and need for protection of the environment.

Outcome:

This subject will sow the seeds of ethics and help them to care about their surroundings.

Syllabus Content:

1. Introduction , components of the environment, environmental degradation
2. Ecology
3. Elements of Ecology ; Ecological balance and consequences of change, principles of environmental impact assessment
4. Air Pollution and Control
5. Atmospheric composition, energy balance, climate, weather , dispersion, sources and effects of pollutants , primary and secondary pollutants, green house effect, depletion of ozone layer, standards and control measures.
6. Noxious gases and vapours (CO, Benzene, Gasoline, Kerosene)
7. Water Pollution and Control
8. Hydrosphere, natural water, pollutants : their origin and effects , river / lake / ground water pollution, standards and control (Specifically arsenic, lead & mercury).
9. Land Pollution
10. Lithosphere , pollutants (municipal, industrial, commercial, agricultural, hazardous solid wastes) ; their origin and effects, collection and disposal of solid waste, recovery and conversion methods.
11. Noise Pollution
12. Sources, effects, standards and control.

Reference books:

1. Masters, G.M., "Introduction to Environmental Engineering and Science", Prentice – Hall of India Pvt. Ltd. , 1991
2. Nebel , B.J., "Environmental Science", Prentice –Hall

Pharmacognosy

Theory

Code : PT 202

Contact : 2L + I T = 3

Credits: 3

Prerequisites:

Pharmacognosy deals with the drugs from natural origin. The basic knowledge of botany, cell biology, zoology and chemistry is essential to understand the science and technology associated with the utilization of drugs from natural origin

Course outcome:

This subject will give them a basic knowledge of different classes of organic compound that are found in medicinal plants, different medicinal plants and their uses. This knowledge will be helpful for further studies in pharmacognosy, pharmacology and medicinal chemistry

Contents of the syllabus:

1. Definition, history and scope of pharmacognosy including indigenous system of medicine.
2. Various system of classification of drugs of natural origin.
3. Adulteration and drug evaluation; significance of pharmacopoeial standards and different types of Extrinsic & Intrinsic factor.
4. Occurrence, distribution, organoleptic evaluation, microscopical evaluation, chemical constituents including tests wherever applicable and therapeutic efficacy of following categories of drugs.
 - a) Laxatives: Aloes, Rhubarb, Castor oil, Ispaghula, Senna
 - b) Cardiotonics – Digitalis,
 - c) Carminatives & G.I. regulators – Coriander, Fennel, Ajowan, Cardamom, Black pepper, Nutmeg, Cinnamon, Clove.
 - d) Astringents – Catechu
5. Occurrence, distribution, organoleptic evaluation, microscopical evaluation, chemical constituents including tests wherever applicable and therapeutic efficacy of following categories of drugs.
 - a) Drugs acting on nervous system – Hyoscyamus, Belladonna, Aconite Ashwagandha, Ephedra, Opium, Cannabis, Nux vomica.
 - b) Antihypertensives – Rauwolfia
 - c) Antitussives – Vasaka, Tulsi
 - d) Antirheumatics – Colchicum
 - e) Antitumour – Vinca
 - f) Antileprotics – Chaulmoogra Oil
 - g) Antidysenterics – Ipecacuanha
 - h) Antiseptics and disinfectants - Neem,
 - i) Antimalarials – Cinchona
 - j) Oxytocics – Ergot
 - k) Vitamins – Shark liver oil

Reference books:

1. Kokate, Gokhale, Purohit; Pharmacognosy
2. Evans W.C, Trease and Evans' Pharmacognosy. Wallis TE; Textbook of pharmacognosy

Pharmacognosy

Practical
Code: 292
Contacts: 3
Credits: 2

Prerequisite: The student must have an knowledge of the physiology and morphology of plants.

Outcome: This subject will give them a basic knowledge of different classes of medicinal compounds, different medicinal plants and their uses. This knowledge will benefit for further studies in pharmacognosy, pharmacology and medicinal chemistry.

Syllabus Content:

1. Identification of crude drugs (containing carbohydrate, lipid, glycosides, volatile oil, alkaloid etc.) by morphological characters.
2. Physical and chemical tests for evaluation of crude drugs wherever applicable
3. Microscopic studies of Senna leaf, Rauwolfia root, Cinamon bark, Datura flower and stem.
4. Identification of fibers and surgical dressings

Reference Books:

1. Practical Pharmacognosy. S. B. Gokhale.

Physiology

Theory

Code : PT 205

Contact : 3

Credits: 3

Prerequisites:

The student must have some basic knowledge on biology specially on cytology and body organization .

Course outcome:

Physiology teaches them about the different systems in our body. This knowledge helps them in subjects like physiology, pharmacology and medicinal chemistry.

Contents of the syllabus:

1. Blood and cardiovascular system :
 - a) The physiological properties, Physical characters, composition and functions of blood.
 - b) The Erythrocytes, Hemoglobin, Hemolysis and suspension stability of the blood, leukocytes and platelets.
 - c) The blood volume, The lymph and tissue fluids.
 - d) The blood pressure.
 - e) Cardiac muscle and its properties, special junctional tissues of heart.
Cardiac cycle, cardiac output, Electrocardiogram, regulation of heart's action.
2. Respiratory system :
 - a) The mechanism of respiration, the air of the lungs, the physical principles governing the respiratory exchanges, the transport and delivery of Oxygen to the tissues. Intracellular oxidations and energy transfer, the carriage of carbon dioxide.
 - b) The control of respiration, periodic respiration, dyspnea, anoxia and other abnormal forms of respiration.
3. Excretory System :
 - a) Renal circulation, Structure and Functions of kidney, Functions of glomerulus, Functions of renal tubules, renal circulation, renal function tests.
 - b) Composition of Urine and the factors affecting the formation of urine, factors controlling the volume of urine.
 - c) Glycosuria, Micturition.
4. Endocrine glands : Anatomical position, structure, function & disorder
5. Digestive system

Reference books:

1. Tortora, Gerard J. : "Principles of anatomy and physiology"
2. Guyton, Arthur C. "Textbook of medical physiology "
3. Waugh, Anne, "Ross and wilson anatomy and physiology: in health and illness" .
4. Chaudhuri, Sujit K., "Concise medical physiology,."
5. Ganong, William F., "Review of medical physiology

Physiology

Practical

Code : PT 295

Contact : 3

Credits: 2

Prerequisites:

The student must have some basic knowledge on biology specially on cytology and body organization .

Course outcome:

Physiology teaches them about the different systems in our body. This knowledge helps them in subjects like physiology, pharmacology and medicinal chemistry.

Syllabus Content:

1. Study of human skeleton and identification of different visceral organs
2. Study of different system with the help of charts and models.
3. Microscopic studies of different tissues and organs
4. Estimation of TC, DC, Hb, ESR, clotting time, bleeding time.
5. Recording of body temperature, pulse rate, blood pressure and brief understanding of ECG-PQRST waves and their significance.
6. Experimental physiology : Handling, weighing, numbering, anaesthetising and injection of mice/rat/rabbit.
7. Isotonic & isometric muscle contractions with special reference to temp., ion, bioactive molecules.

Reference:

1. A concise note on medical laboratory technology. C.K. Maity.

Pharmaceutical Chemistry (Organic Chemistry)

Theory

Code: PT 304

Contacts: 3L+1T

Credits: 4

Prerequisites:

Successful completion of all Semester 2 courses of B. Pharm as per WBUT syllabus. Students should have a clear concept of aromaticity, nucleophilic and electrophilic substitution reactions of aromatic compounds.

Outcome:

The students learn about heterocyclic compounds, and electrophilic and nucleophilic reactions, which helps them in acquiring further knowledge in biochemistry, pharmacology and medicinal chemistry.

Syllabus content:

1. Nucleophilic aromatic substitutions:
2. Electrophilic and nucleophilic aromatic substitution
3. Synthesis and reaction of phenols, aromatic sulfonic acids, nitro-compound, anilines, diazonium salt, chemistry of carbohydrate
4. Polynuclear aromatic system :
5. Heterocyclic Compounds : Nomenclature of heterocyclic compounds, Chemistry, preparations and properties of some important heterocyclic compounds containing 5,6 atoms with one or two heteroatoms like O,N,S., Napthalene, Anthracene, etc.

Reference books:

1. Organic Chemistry . R.T. Morrison
2. Organic Chemistry. I.L. Finar. Volume 1 and 2.
3. A guidebook of mechanism in organic chemistry. Peter Sykes
4. Stereochemistry of organic compounds. E.L. Eliel

Pharmaceutical Chemistry (Organic Chemistry)

Practical

Code: PT 394
Contacts: 3
Credits: 2

Prerequisites:

Students should have a theoretical knowledge of synthetic procedure and substitution reactions of heterocyclic compounds and a clear concept of heterocyclic nucleic acid structures.

Outcome:

The students will be able to synthesize the different heterocyclic chemical compounds and synthesize compounds using electrophilic and nucleophilic substitution reactions.

Syllabus Content:

- At least two exercises in synthesis involving various heterocyclic ring systems. Workshop on molecular modelling of different isomers, molecular modelling on double helical structure of nucleic acid showing hydrogen bonding.
- At least 3 reactions involving electrophilic aromatic substitutions.

Reference Books:

1. Vogel's textbook of practical organic chemistry. Edited by B. S. Furniss.

Pharmaceutical Analysis

Theory

Code: PT 301

Contacts: 3L+1T

Credits: 4

Prerequisites:

Students should have an understanding of volumetric analysis, gravimetric analysis, and importance of non-aqueous titration separation techniques in Pharmaceutical analysis.

Outcome:

The students learn about different types of fundamental instrumental methods of analysis along with complexometric and non-aqueous titration that helps them in project planning and also in subjects like medicinal chemistry, pharmaceuticals

Syllabus Content:

Theoretical considerations, and application in drug analysis.

1. Non-aqueous titrations
2. Complexometric titrations.
3. Miscellaneous Methods of Analysis : Diazotisation titrations, Kjeldahl method of nitrogen estimation, Karl-Fischer titration, Oxygen flask combustion,
4. Chromatography : The following techniques will be discussed with relevant examples of Pharmacopeial products. TLC, HPLC, GLC, Paper Chromatography and Column Chromatography.
5. Theoretical considerations, and application in drug analysis :
 - a. Potentiometry
 - b. Conductometry
 - c. Amperometry

Reference Books:

1. Vogel's textbook of quantitative chemical analysis. Edited by JH Jeffery, J Basset, J Mendham, RC Denny. 5th edition.
2. Practical pharmaceutical chemistry: Part 1 and 2, Edited and authored by A. H. Beckett and B Stanlake

Pharmaceutical Analysis

Practical

Code: PT 391
Contacts: 3
Credits: 2

Prerequisites:

Students should have a basic knowledge of non-aqueous titration, complexometric titration, chromatographic techniques, significance of excipients and alcohol in drug formulations.

Outcome:

The students learn about different types of fundamental instrumental methods of analysis along with complexometric and non-aqueous titration that helps them in project planning and also in subjects like medicinal chemistry, pharmaceuticals

Syllabus Content:

1. Non aqueous Titrations : Preparation and standardization of perchloric acid and sodium/potassium/lithium methoxides solutions; Estimations of at least one pharmacopoeial product.
2. Complexometric Titrations : Preparation and standardization of EDTA solution, at least one exercise related to pharmacopoeial assays by complexometric titration.
3. Miscellaneous Determinations : Exercises involving Karl-Fischer, Determination of alcohol content in liquid galenical.
4. Experiments involving separation of drugs from excipients and estimation.
5. Chromatographic analysis of some pharmaceutical products.

Reference books:

1. Vogel's textbook of quantitative chemical analysis. Edited by JH Jeffery, J Basset, J Mendham, RC Denny. 5th edition.
2. Practical pharmaceutical chemistry: Part 1 and 2, Edited and authored by A. H. Beckett and B Stanlake

Anatomy, physiology and health education(APHE)

Theory

Code : PT 305

Contacts: 2L + 1T = 3

Credits : 3

Prerequisites:

The student must have some basic knowledge on biology specially on cytology and body organization .

Course outcome:

This subject acts as the stepping stone for the subjects pharmacology and medicinal chemistry as students gather knowledge on the correlation between diseases and anatomy.

Syllabus Content:

1. Elementary Tissues of the Human Body : Anatomical position, structure, characteristic & functions of Epithelial, connective, muscular and nervous tissues, their sub-types.
2. Osseous System : Structure, composition and functions of skeleton. Classification of joints, types of movements of joints, disorders of joints.
3. Skeletal Muscles : Gross anatomy, physiology of muscle, contraction, physiological properties of skeletal muscles and their disorders.
4. Haemopoietic system : Composition and functions of blood and its elements, their disorders, blood groups and their significance, mechanism of coagulation, disorders of platelets and coagulation.
5. Lymph and Lymphatic system: Composition, formulation and circulation of lymph; disorders of lymph and lymphatic system. Basic physiology and functions of spleen.
6. Digestive System : General, anatomical outline of gastrointestinal tract, function of different parts including those of liver, pancreas and gall bladder.
7. Respiratory System : Anatomy of respiratory system and organs.
8. Nervous System : General outline of central nervous system and autonomic nervous system.
9.
 - a) Demography and family planning : Medical termination of pregnancy.
 - b) Communicable diseases: Brief outline, their causative agents, modes of transmission and prevention (Chicken pox, measles, influenza, diphtheria, tuberculosis, poliomyelitis, helminthiasis, malaria,
 - c) Filariasis, rabies, trachoma, tetanus, leprosy, syphilis, gonorrhoea and AIDS.
 - d) First Aid : Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods

Reference:

1. Tortora, Gerard J. : "Principles of anatomy and physiology"
2. Guyton, Arthur C. "Textbook of medical physiology "
3. Waugh, Anne, "Ross and wilson anatomy and physiology: in health and illness" .
4. Chaudhuri, Sujit K., "Concise medical physiology,,"
5. Ganong, William F., "Review of medical physiologyPharmaceutical Chemistry (Bio-Chemistry)

Pharmaceutics (Physical Pharmacy)

Theory

Code : PT 306

Contact : 3L + I T = 4

Credits: 4

PREREQUISITES:

The student must have some basic knowledge of different dosage form, essential mathematics, concepts and skills to calculate numericals using the formula, ratio, and dimensional analysis methods. They must have the knowledge of physics as well as chemistry. The students should have the ability to apply the principles from all of these areas in solving a given problem related to preparation and evaluation of the dosage form.

COURSE OUTCOME:

The knowledge of importance of physical properties of the different pharmaceutical ingredients and the factors influencing them is very valuable for pharmaceutical dosage form design.

CONTENTS OF THE SYLLABUS:

- Matter, Properties of Matter : State of matter, change in the state of matter, Latent heat and vapor pressure, sublimation critical point, Eutectic mixtures, gases, aerosols-inhalers, relative humidity, liquid complexes, liquid crystals, glassy state, solids-crystalline, amorphous and polymorphism.
- Micromeritics and Powder Rheology : Particle size and distribution, average particle size, number and weight distribution, particle number, methods for determining particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.
- Surface and Interfacial Phenomenon: Liquid interface, surface and interfacial tensions, surface free energy, measurement of surface and interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB classification, solubilization, detergency, adsorption at solid interfaces, solid gas and solid-liquid interfaces, complex films, electrical properties of interface.
- Viscosity and Rheology : Newtonian systems, Law of flow, kinematic viscosity, effect of temperature, non-Newtonian systems, pseudoplastic, dilatant, plastic, thixotropy, thixotropy in formulation, determination of viscosity, capillary, falling ball, rotational viscometers.
- Dispersion systems : Colloidal dispersions : Definition, types, properties of colloids, protective colloids, applications of colloids in pharmacy; Suspensions and Emulsions: Interfacial properties of suspended particles, settling in suspensions, theory of sedimentation, effect of Brownian movement, sedimentation of flocculated particles, sedimentation parameters, wetting of particles, controlled flocculation, flocculation in structured vehicles, rheological considerations, Emulsions- types, theories, physical stability.
- Complexation and Protein Binding : Classification of complexes, methods of preparation and analysis, applications. Protein binding, binding equilibrium, analysis, Thermodynamic treatment to stability constant.
- Kinetics and Drug Stability : Half-life determination, Influence of temperature, light, solvent, catalytic species and other factors, Accelerated stability study, expiration dating, decomposition and stabilisation of medicinal agent.

REFERENCE BOOKS:

1. Physical pharmacy: physical chemical principles in the pharmaceutical sciences by Martin, Alfred
2. Aulton's pharmaceutics: the design and manufacture of medicines Edited by Aulton, Michael E.
3. Martin's physical pharmacy and pharmaceutical sciences: Physical chemical and biopharmaceutical principles in the pharmaceutical sciences by Sinko, Patrick J.

Physical Pharmacy

Practical

Code: PT 396
Contacts: 3
Credits: 2

Prerequisite:

The student must have some basic knowledge of different dosage form, essential mathematics, concepts and skills to calculate numericals using the formula, ratio, and dimensional analysis methods. They must have the knowledge of physics as well as chemistry. The students should have the ability to apply the principles from all of these areas in solving a given problem related to preparation and evaluation of the dosage form.

Outcome:

The students will know about the determination of particle size, surface area, properties of powder which is helpful in manufacturing of solid dosage form, the determination of rheologic properties, choice of viscometer, different types of viscometer, the classification of different types of complexes and mechanism of protein binding, the kinetics of reactions and drug stability.

Syllabus content:

1. Determination of particle size, Particle size distribution and surface area using various methods of Particle size analysis.
2. Determination of derived properties of powders like density, porosity, compressibility, angle of repose etc.
3. Determination of surface/interfacial tension. HLB value and critical micellar concentration of surfactants.
4. Study of rheological properties of various types of systems using different Viscometers, evaluation of intrinsic viscosity of a system by viscosity determination using various concentration and if possible, determination of molar mass
5. Studies of different types of colloids and their properties.
6. Preparation of various types of suspensions and determination of their sedimentation parameters.
7. Preparation and stability studies of emulsions.
8. Accelerated stability testing, shelf-life determination and expiration dating of pharmaceuticals.
9. The effect of pH of the solubility on a slightly soluble weak acid.

Reference Books:

1. Martin's physical pharmacy and pharmaceutical sciences: Physical chemical and biopharmaceutical principles in the pharmaceutical sciences by Sinko, Patrick J.

Pharmaceutical Engineering

Theory

Code: PT 307
Contacts: 3L + 1T = 4
Credits: 4

Prerequisites:

The student must have the basic knowledge of stoichiometry, Dimensional analysis and different types of graphical representations.

Outcome:

The knowledge of basic unit operations and their importance in day to day running of pharmaceutical unit is emphasized to the students. This knowledge is further improved in the ensuing pharm. Engineering and other pharmaceuticals subjects.

Syllabus Content:

1. Stoichiometry : Units and their conversions, molecular units, basic laws, mole fraction, problems on stoichiometry, material balance and related problems, energy balance and related problems. Dimensional analysis, different types of graphic representations.
2. Fluid Flow : Different manometers and their application, types of flow, boundary layer concept, Reynold's number, Bernoulli's theorem, fluid friction, flow measuring devices, non-Newtonian fluid flow – basic concept.
3. Material Handling:
 - a) Liquid handling – Different types of pumps.
 - b)
 - c) Gas handling-Variou types of fans, blowers and compressors.
 - d) Solid handling – Bins, Bunkers, Conveyers, Other solid transport systems.
4. Filtration and Centrifugation : Theory of filtration, industrial filters like leaf filters, rotary filter, filter press edge filter etc. filter aids, and resistances, mathematical problems. Principles of centrifugation, centrifugal filters and sedimentors, Pharmaceutical applications.
5. Industrial Hazards & Safety precautions : Different types of hazards like mechanical, electrical, chemical, dust, fire etc. Preventive methods and precautions. First Aid – shock, fainting, wounds, Acid and Alkali burns, poison antidotes, artificial respiration etc.

Reference books:

1. Introduction to chemical engineering, Badger, Walter L.
2. Unit operations of chemical engineering, McCabe, Warren L.

Engineering Drawing

Practical

Code: PT 397

Contacts: 3

Credits: 2

Prerequisite:

The student must have an idea about the dimensional views.

Outcome:

The knowledge engineering drawing importance in day to day running of a pharmaceutical unit is emphasized to the students. This knowledge is further improved in the ensuing pharm. Engineering and pharmaceutics subjects.

Syllabus Content:

1. I.S. Conventions of drawing – lettering, scales etc., Orthographic Projection – first and third angle concepts.
2. Isometric drawing and Dimensioning.
3. Sections and Sectional Views Bolted and riveted joints Welded joints
4. Pipe joints and fittings
5. Types of flanges and working drawing of pulley, key etc. Pressure vessel and auxiliaries – skirt, saddle etc.
6. Line drawing of agitator, ball mill, mixer, filter press, Centrifuge, dryer, evaporator Calandria, granulator, sieving machine, tablet compressing machine etc.
7. Concept of flow diagram.

Reference Books:

1. Fundamentals of engineering drawing. S. Pal, M. Bhattacharya

Computer Science and Application

Theory

Code: CS 303

Contacts: 3L + 1T

Credits: 4

Prerequisite:

The student must be well versed with the concept of hardwares and softwares.

Outcome:

The knowledge of hardware and software components along with hands on knowledge on RDBMS and programming tools comes handy in operation of pharmacy and also serves as a stepping stone for the computational chemistry covered in higher semesters.

Syllabus content:

1. Computers Applications :
 - 1.1 Introduction to Computers. History of Computer development and respective generation: classification of computers, different parts of modern digital computer and their functions, hardware and software.
 - 1.2 Number system: Binary, decimal, hexadecimal and octal number systems and their inter conversion.
 - 1.3 Boolean Algebra: definition and rules, logical expressions, simplification of logical expressions (K-Map not needed). Logic Gates: Introduction to logic gates, AND, OR, NOT, NOR, NAND, XOR logic gates, truth tables, simple digital circuits using logic gates.
 - 1.4 Basic concept of operating system and its functions, classification, 9MS-DOS commands will be learned and used in Laboratory only)
 - 1.5 Introduction to computer language, Alphabets in C
Keywords in C, Data Variables, Data Types and Rules for naming and declaring data variables, Basic Data types in C, constants, Enumerated Data Types, C Instructions and Rules for Writing Them Types of instructions

Data Manipulation Instructions
Input/Output Instructions
Flow control instructions
Decision Control Instructions
If
If-else
If-else-if Nested
if-else
Conditions
Loop Control Instructions
For loop
While loop
Do while
Selection Instructions
Functions
Components of Function Name of a function Body of a function
Local variables of a function Parameters of
Arguments to a function Return Values
Prototype of a function
Arrays
What is an array? Array Declaration Array
Initialization
Accessing individual elements of an array
Two Dimensional Arrays
Accessing the elements of a two dimensional array
More than two dimensions
Passing an array element to a function

Simple programs using C

Reference Books:

1. Let us C. Y.P. Kanetkar
2. Database System Concepts. H.F. Korth.

Computer Science and Applications

Practical:
Code: CS 393
Contacts : 3
Credits : 2

Prerequisites:

The student should have logical abilities.

Outcomes:

The knowledge of hardware and software components along with hands on knowledge on RDBMS and programming tools comes handy in operation of a pharmacy and also serves as a stepping stone for the computational chemistry covered in higher semesters.

Syllabus Content:

1. Executing MS-DOS commands, creating and executing batch file, writing and executing simple programs in C.
2. Create tables using Oracle, insert data into the tables, update tables, modify the structure of a table, implement Foreign key and primary key constraints, Design and create a small inventory database, design and create a database of a small Hospital, Design drug-drug interaction database, retrieve different types of information using SQL.
3. Practical designed on the use of computers in drug information center, prescription filing and documentation of information on drug interaction.

Reference Books:

1. Let us C. Y.P. Kanetkar
2. Database System Concepts. H.F. Korth.

Pharmaceutics (Pharmaceutical Technology-I)

Theory

Code : PT 406

Contact : 3L + 1T = 4

Credits: 4

Prerequisites:

The student must have the basic knowledge of drug and excipients. He/ she should also have the basic knowledge of dose and the different types of dosage forms.

Course Outcome:

The knowledge on different pharmaceutical dosage forms are imparted on students. This knowledge comes handy while handling a pharmacy or a manufacturing unit or in the further courses.

Contents Of The Syllabus:

- Liquid dosage forms : Introduction, types of additives used in formulation, vehicles, stabilization, preservatives, suspending agents, emulsifying agents, solubilisers, colours, flavours and others; Manufacturing, packaging and evaluation.
- Semisolid dosage forms: Definition, types, mechanism of drug penetration, factors influencing penetration, semi-solid bases and their selection, general formulation of semi-solids, clear gels manufacturing procedure, evaluation and packaging.
- Suppositories : Definition, size, shape and doses, ideal requirements, factors affecting drug absorption, type of bases, manufacturing procedure, storage, packaging, stability of suppositories.
- Extraction and Galenical Products : Principle and method of extraction, factors affecting extraction rate, choice extraction procedure, preparation of infusion, tinctures, dry and soft liquid extracts.
- Blood products and plasma substitutes : Collection, processing and storage of Whole human blood and all fractions individually. Plasma substitutes – ideal requirements, PVP, dextran etc. for control of blood pressure as per I.P.
- Pharmaceutical Aerosol : Mode of operation, Definition, propellants, manufacturing and packaging methods, container with all parts, pharmaceutical application and testing.
- Ophthalmic preparation : Requirements, eye drops, eye lotions, eye ointments, formulation, additives, preparation, sterilization, packaging, evaluation, contact lens solution.

Reference Books:

1. Cooper & Gunn's dispensing for pharmaceutical students, Revised by Carter, S. J.
2. Ansel's pharmaceutical dosage forms and drug delivery system, Allen, Loyd V.
3. Pharmaceutical compounding and dispensing, Marriott, John F.

Pharmaceutical Technology I

Practical

Code: PT 496(1)

Contacts: 3P

Credits: 2

Prerequisites:

The student should be well versed with different pharmaceutical formulations and their preparation.

Outcome:

The knowledge on different pharmaceutical dosage forms are imparted on students. This knowledge comes handy while handling a pharmacy or a manufacturing unit or in the further

Syllabus Content:

1. Preparation, evaluation and packaging of liquid orals like solution, suspension, emulsion; Eye drops, eye ointments, ointments, creams, suppositories.
2. Preparation of pharmacopoeal extracts and galenical products utilizing various methods of extraction.

Reference Books:

1. Cooper & Gunn's dispensing for pharmaceutical students, Revised by Carter, S. J.
2. Ansel's pharmaceutical dosage forms and drug delivery system, Allen, Loyd V.
3. Pharmaceutical compounding and dispensing, Marriott, John F.

Pharmaceutical Chemistry (Biochemistry)

Theory

Code: PT 404

Contacts: 3L+1T

Credits: 4

Prerequisites:

The students should have a clear understanding of physiology, anatomy, physiology and health education and chemical basis of alkane, alkene, alkyne and heterocyclic compounds.

Outcome:

The students learn about the chemistry and biological importance of biological macromolecules. And in the practical paper they get hands on knowledge on qualitative and quantitative estimation of these. This knowledge is helpful for them in learning about pharmacology, medicinal chemistry and pharmacology

Syllabus content:

1. Transport processes across cell membrane.
2. Production of ATP and its biological significance
3. Introduction to 3D structure of protein, stability and denaturation of protein, allosteric proteins.
4. Enzymes : Nomenclature, enzyme kinetics and its mechanism of action, mechanism of inhibition, enzymes and iso-enzymes in clinical diagnosis.
5. Co-enzymes : Vitamins as co-enzymes and their significance, Metals as co-enzymes and their significance.
6. Carbohydrate Metabolism : Conversion of polysaccharide to glucose – 1 – phosphate, Glycolysis and fermentation and their regulation, Gluconeogenesis and glycogenolysis, Metabolism of galactose and galactosemie, Role of sugar nucleotides in biosynthesis and Pentosephosphate pathway.
7. The Citric Acid Cycle : Significance, reactions and energetic of the cycle, Amphibolic role of the cycle, and Glyoxalic acid cycle.
8. Lipids Metabolism : Oxidation of fatty acids, β -oxidation & energetic, β -oxidation, β -oxidation, Biosynthesis of ketone bodies and their utilization, Biosynthesis of saturated and unsaturated fatty acids, Control of lipid metabolism, Essential fatty acids & eicosanoids (prostaglandins, thromboxanes and leukotrienes) phospholipids, and sphingolipids.
9. Biological Oxidation : Redox-Potential, enzymes and co-enzymes involved in oxidation Reduction & its control, The respiratory chain, its role in energy capture and its control, Energetic of oxidative phosphorylation, Inhibitors of respiratory chain and oxidative phosphorylation, Mechanism of oxidative phosphorylation.

Reference books:

1. Harper's illustrated biochemistry. R.K. Murray
2. Outline of Biochemistry. E. E. Conn.
3. Lehninger's Principles of biochemistry. D.L. Nelson

Pharmaceutical Chemistry (Bio-Chemistry)

Practical

Code: PT 494

Contacts: 3

Credits: 2

Prerequisites:

Successful completion of all Semester 3 courses of B. Pharm as per WBUT syllabus. Students should have a theoretical knowledge of lipid and carbohydrate chemistry and importance of different biochemical parameters under different diseased conditions.

Outcome:

The students learn about the chemistry and biological importance of biological macromolecules. And in the practical paper they get hands on knowledge on qualitative and quantitative estimation of these. This knowledge is helpful for them in learning about pharmacology, medicinal chemistry and pharmacology

Syllabus Content:

1. Experiments of sugar – test for reducing sugar, colorimetric estimation of sugar, chromatographic separation of sugars.
2. Titration curve for amino acids
3. Separation of amino acids by TLC method.
4. Experiments on lipids – saponification no., iodine no., separation of lipids by TLC.
5. Quantitative estimation of amino acids, protein,
6. Experiments on clinical bio-chemistry – blood glucose estimation, cholesterol in blood, separation of plasma proteins by paper electrophoresis, non-protein N₂ – in blood, estimation of SGOT, SGPT and ALP in the serum.
7. Experiments on enzymes – effect of pH, effect of temperature and use of inhibitors.

Reference Books:

1. An Introduction to practical biochemistry. D.T. Plummer.
2. Modern experimental biochemistry. R. Boyer

Pharmacognosy

Theory

Code: PT 402

Contacts: 3L + 1T = 4

Credits: 4

Prerequisites:

Basic knowledge of Pharmacognosy which students have learnt in second semester is essential to understand the content of the syllabus. The student should also have knowledge of analytical pharmacognosy, pharmacognostic profiling of drugs and indigenous system of medicines

Course outcome:

The knowledge of pharmacognosy helps in attainment of further information on medicinal chemistry as well as pharmacognosy

Contents of the syllabus:

1. Resins : Study of Drugs Containing Resins and Resin Combination like Colophony, podophyllum, jalap, cannabis, capsicum, myrrh, asafoetida, balsam of tolu, balsam of peru, benzoin, turmeric, ginger.
2. Tanins : Study of tannins and tannin containing drugs like Gambir, gall and myrobalan.
3. Volatile Oils : General methods of obtaining volatile oils from plants; Study of volatile oils of Mentha, Cassia, Lemon peel, Orange peel, Lemon grass, Citronella, Caraway, Dill, Spearmint, Eucalyptus, Chenopodium, Valerian, Musk, Gaultheria, Sandal wood.
4. Fibers : Study of fibres used in pharmacy such as cotton, silk, wool, nylon, glass-wool, polyester and asbestos.
5. Pharmaceutical aids : Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatine and natural colours.
6. Study of the biological sources, commercial varieties, chemical constituents, substitutes, adulterants, uses, diagnostic macroscopic and microscopic features and specific chemical tests of following groups of drugs containing glycosides :
 - i) Saponins: Ginseng, dioscorea, sarsaparilla and senega
 - ii) Cardioactive sterols : squill, strophanthus and thervetia
 - iii) Anthraquinone cathartics : cascara
 - iv) Others : Psoralea, Ammi majus, Ammi visnaga, gentian, chirata, quassia.
7. Studies of traditional drugs, Common vernacular names, botanical sources, morphology, chemical nature of chief constituents, pharmacology, categories and common uses of following indigenous drugs :
Amla, Kantkari, Satavari, Tylophora, Bhilawa, Bach, Rasna, Punarnava, Chitrack, Apamarg, Gokhru, Shankhapushpi, Brahmi, Arjuna, Ashoka, Methi, Lahrun, Palash, Guggal, Gyunmema, Shilajit.
8. The holistic concept of drug administration in traditional systems of medicine, Introduction to ayurvedic preparations like Arishta, Asvas, Gutikas, Tailas, Churnas, Lehyas, Bhasmas.

Reference books:

1. Kokate, Gokhale, Purohit; Pharmacognosy
2. Evans W.C, Trease and Evans' Pharmacognosy
3. Wallis TE; Textbook of pharmacognosy Pharmaceutical Chemistry (Medicinal Chemistry)

Pharmacognosy

Practical

Code: PT 492

Contacts: 3

Credits: 2

Prerequisites:

Basic knowledge of Pharmacognosy which students have learnt in second semester is essential to understand the content of the syllabus. The student should also have knowledge of analytical pharmacognosy, pharmacognostic profiling of drugs and indigenous system of medicines

Course outcome:

The knowledge of pharmacognosy helps in attainment of further information on medicinal chemistry, pharmacology, drug formulation as well as pharmacognosy

Contents of the syllabus:

1. Microscopic study of powdered crude drugs containing volatile oil, glycosides, alkaloids etc.
2. Laboratory experiments on isolation, identification, separation and purification of various groups of constituents present in crude drugs of pharmaceutical significance.
3. Chemical tests for alkaloids, glycosides, steroids, flavonoids, tannins and resins etc.

Reference books:

1. Kokate, Gokhale, Purohit; Pharmacognosy
2. Evans W.C, Trease and Evans' Pharmacognosy
3. Wallis TE; Textbook of pharmacognosy Pharmaceutical Chemistry (Medicinal Chemistry)

Physiology

Theory
Code: PT 405
Contacts: 3L + 1T = 4
Credits: 4

Prerequisites:

The student must have some basic knowledge on biology specially on cytology and body organization .

Course outcome:

The students will gain the basic knowledge about the nervous system along with the special senses and natural reproduction. The knowledge obtained in this subject helps the students in understanding the cholinergic and adrenergic systems, and other endocrine systems, which will be useful for both medicinal chemistry and pharmacology.

Course content:

1. Nervous system, Central nervous system : Nerve impulse; Synapse Reflex arc, Receptor, organs, reflex action; Physiological mechanism governing the posture and equilibrium; The spinal cord and brain stem; The extra-pyramidal system, the thalamus and hypothalamus; Condition reflex, sleep; Cerebrum; cerebrospinal fluid. Autonomic nervous system : Classification, general arrangement, dual supply, drugs action on ANS, Structure of autonomic ganglia, general arrangement and function of Sympathetic and parasympathetic system.
2. Special sense : Taste (gustation). Smell (olfaction), vision and hearing
3. Body temperature and its regulation, pyrexia and hypothermia.
4. Reproductive system

Reference:

1. Tortora, Gerard J. : "Principles of anatomy and physiology"
2. Guyton, Arthur C. "Textbook of medical physiology "
3. Waugh, Anne, "Ross and Wilson anatomy and physiology: in health and illness" .
4. Chaudhuri, Sujit K., "Concise medical physiology,."
5. Ganong, William F., "Review of medical physiology"

Pharmaceutical engineering

Theory

Code : PT 407

Contact : 3L + 1T = 4

Credits: 4

Prerequisites:

The student must have the basic knowledge of stoichiometry, Dimensional analysis and different types of graphical representations He/ she should also have the art of engineering drawing.

Course outcome:

Pharm. Engineering renders knowledge about the basic unit operations that are taking place in pharmaceutical industry and the different factors associated with it. This information is useful for both pharmaceuticals and pharmaceutical engineering.

Contents of the syllabus:

- Heat Transfer : Heat transfer by conduction, problems on steady state heat conduction; heat transfer by convection, heat transfer coefficient, heat exchangers, problems on convection, heat transfer by radiation, Stefan's and Kirchoff's Laws, pharmaceutical applications.
- Evaporation : Principles of evaporation, different evaporators like short and long tubes, forced convective and agitated film evaporators. Factors affecting evaporation rate. Multiple effect evaporation, pharmaceutical applications, Mathematical problems.
- Size Reduction and Size Separation : Utility of size reduction and separation, Laws of crushing and grinding, different crushers and grinders like Roll crusher, ball mill, hammer mill, colloid mill, fluid energy mill etc.; fluid classifiers, Stoke's Law, laws of sedimentation, Powder characterisation, particle size analysis.
- Mixing : Sampling and statistics of mixing, Different mixers: solid-solid, solid-liquid and liquid- liquid, Problems of mixing and mixer selection.
- Crystallisation: Introduction – Crystal characteristics, solubility curves, supersaturation theory, nucleation, crystal growth etc., Industrial crystallisers like Swenson-Walker, tank type, agitated type and vacuum type etc. Different problems of crystallisation like caking etc.
- Materials of construction: Introduction – Corrosion, material properties, metals, non-metals and alloys for fabrication, specially stainless steel, aluminium, glass, polymers, rubber, ceramics and different Ni, Cr, Mn, Mo, Al, Fe, Si alloys. Different linings and surface coatings.

Reference books:

1. Introduction to chemical engineering, Badger, Walter L.
2. Unit operations of chemical engineering, McCabe, Warren L.
3. Chemical process principles: material and energy balances, Part 1, Hougen, O. A.

Pharmaceutical engineering

Practical Code : PT 497
Contacts : 3 hrs./week
Credit : 2

Prerequisites:

The student must have the basic knowledge of stoichiometry, Dimensional analysis and different types of graphical representations He/ she should also have the art of engineering drawing.

Course outcome:

Pharm. Engineering renders knowledge about the basic unit operations that are taking place in pharmaceutical industry and the different factors associated with it. This information is useful for both pharmaceuticals and pharmaceutical engineering.

Syllabus Content:

Practicals will be conducted as per the subject content in theory (at least 7 experiments)

Reference Books:

Reference books:

1. Introduction to chemical engineering, Badger, Walter L.
2. Unit operations of chemical engineering, McCabe, Warren L.
3. Chemical process principles: material and energy balances, Part 1, Hougen, O. A.

Pharmaceutics (Pharmaceutical Technology-II)

Theory

Code : PT 506

Contact : 3L + 1T = 4

Credits: 4

Prerequisites:

The student must have the basic knowledge of dose and the different types of dosage forms. He/ she should have the art of dispensing and should have the knowledge of handling instruments.

Course Outcome:

The information on solid dosage forms like tablets and capsules, their formulation and quality control serves as an important prerequisite for dosage form design

Contents Of The Syllabus:

- Tablets :
 - ✓ Formulation of different types of tablets, granulation technology on large scale by various techniques, physics of tablets making, different types of tablet compression machinery and equipment employed, evaluation of tablet, Manufacturing area design and layout flow diagram of tablet manufacturing.
 - ✓ Coating of tablets : Types of coating, sugar coating, film coating, film forming materials, formulation of coating solution, equipment for coating, coating process, evaluation of coated tablets, Physiological availability and tablet coating.
 - ✓ Stability Kinetics and quality assurance.
- Capsules : Advantages and disadvantages of capsule dosage form, material for production of hard gelatine capsules, size of capsules, method of capsule filling, sealing and packaging, Soft gelatine capsules shell and its content, important of base adsorption and factors, quality control, stability testing and storage.
- Cosmetology and Cosmetic preparation : Fundamentals of cosmetic science, structure and function of skin and hair, formulation, preparation, packaging and evaluation of cosmetic products for skin, hair, eye, denitrifies and preparations like nail polish, lipstick; baby care products; shaving cream, after-shave lotions, etc.

Reference Books:

1. Modern pharmaceutics, Banker, Gilbert S.
2. Ansel's pharmaceutical dosage forms and drug delivery system, Allen, Loyd V.
3. Poucher's perfumes, cosmetics and soaps, Edited by Butler, Hilda
4. The theory and practice of industrial pharmacy, Lachman, Leon

Pharmaceutics (Pharmaceutical Technology-II)

Practical
Code: PT 596
Contacts: 3
Credits: 2

Prerequisites:

The student must have the basic knowledge of dose and the different types of dosage forms. He/ she should have the art of dispensing and should have the knowledge of handling instruments.

Course Outcome:

The information on solid dosage forms like tablets and capsules, their formulation and quality control serves as an important prerequisite for dosage form design

Contents Of The Syllabus:

1. Formulation of various types of cosmetics for skin, hair, eye and different type of preparations.
2. Preparation, evaluation and packaging of tablets
3. Preparation , evaluation and packaging of hard gelatine capsules.

Reference Books:

1. Modern pharmaceutics, Banker, Gilbert S.
2. Ansel's pharmaceutical dosage forms and drug delivery system, Allen, Loyd V.
3. Poucher's perfumes, cosmetics and soaps, Edited by Butler, Hilda
4. The theory and practice of industrial pharmacy, Lachman, Leon

Pharmacology

Code: PT-508
Contact: 3L = 3
Credits: 3

Prerequisites:

The student must have some basic command of Physiology and Chemistry.

Course Outcome:

The subject helps the students to understand and correlate between biochemistry, physiology, medicinal chemistry and helps them to underlying conditions for diseases.

Contents Of The Syllabus:

1. General Pharmacology: Introduction to Pharmacology, routes of drug administration, mechanism of action, Combined effect of drugs, Factors modifying drug action and related conditions.
2. Fate of the drug and its administration, Absorption, Distribution, Metabolism and Excretion of drugs (ADME), Adverse Drug Reactions, drug interaction, Bio-transmission.
3. Pharmacology of Peripheral Nervous System :
 - a) Neurohumoral transmission (amines and related substance)
 - b) The choline esters and cholinesterase, Atropine and atropine like drugs, Drugs that block neuro-muscular or ganglionic transmission.
 - c) Neuromuscular blocking agents, Autagonists of adrenergic neurone activity, the cyclic nucleotides, 5-hydroxy tryptamine, histamine and its antagonist
4. Pharmacology of Central Nervous System :
 - a) Neurohumoral transmission in the C.N.S.
 - b) General Anaesthetics, local anaesthetics
 - c) Alcohols and disulfiram
 - d) Sedatives, hypnotics, Anti-anxiety agents
 - e) Psychopharmacological agents: Anti-depressant, mania agents
 - f) Anti-epileptics drugs
 - g) Anti-Parkinsonian Drugs
 - h) Analgesics, Antipyretics, Anti-inflammatory and Anti-gout drugs
 - i) Narcotic analgesics and antagonists
 - j) Drug-Addiction and Drug Abuse.
5. Screening and testing of drugs
6. Toxicity of drugs

REFERENCE BOOKS:

1. Essentials of medical pharmacology , Tripathi, K. D
2. Lippincott's illustrated reviews: Pharmacology , Edited by Finkel, Richard.
3. Clinical pharmacology, Bennett, P. N.
4. Screening Methods in Pharmacology volume: I, Robert H. Turner.
5. Screening Methods in Pharmacology volume: II, Robert H. Turner.

Pharmaceutical microbiology

Theory

Code: PT 509
Contacts: 3L
Credits: 3

Prerequisites:

The student must have some basic command of chemistry and physiology .

Course Outcome:

The knowledge in this subject is a prerequisite for both biotechnology and medicinal chemistry. It also helps them in project planning.

Contents Of The Syllabus:

1. Introduction to the scope of microbiology
2. Structure of bacterial cell.
3. Classification of microbes and their taxonomy. Actinomycetes bacteria, rickettsiae, spirochetes and viruses.
4. Identification of Microbes : Stains and types of staining techniques, electron microscope.
5. Nutrition, cultivation, isolation of bacteria, actinomycetes, fungi, viruses, etc.
6. Control of microbes by physical and chemical methods.
 - a) Disinfection, factors influencing disinfectants, dynamics of disinfection, disinfectants and antiseptics and their evaluation.
 - b) Sterilization, different methods, validation of sterilization methods & experiments.
7. Sterility testing of all Pharmaceutical products.
8. Immunity, primary and secondary, defensive mechanisms of body, microbial resistance, interferon.
9. Microbial assays of antibiotics, Vitamins (Vitamin B₁₂ & Niacin), amino acids.
10. Diseases and disease-producing microorganisms, like *Staphylococcus aureus*, *Streptococcus pyrogenes*, *E. coli*, *Sulmonella typhi*, *Vibrio choleri* and *Yersinia pestis*; virulence factors.
11. Water analysis by microbiological method
12. Pyrogen by LAL Test

Reference books:

1. Microbiology. M.j. Pelczar.
2. Pharmaceutical Microbiology. W.B. Hugo

Pharmaceutical microbiology

Practical

Code: PT 599
Contacts: 3
Credits: 2

Prerequisites:

The student must have some basic command of chemistry and physiology .

Course Outcome:

The knowledge in this subject is a prerequisite for both biotechnology and medicinal chemistry. It also helps them in project planning.

Syllabus Content:

Experiments devised to prepare various types of culture media, sub-culturing of common aerobic and anaerobic bacteria, fungus and yeast, various staining methods, various methods of isolation and identification of microbes, sterilization techniques and their validation of sterilizing techniques, evaluation of antiseptics and disinfectants, testing the sterility of pharmaceutical products as per I.P. requirements, microbial assay of antibiotics and vitamins, water analysis.

Reference books:

1. Microbiology. M.J. Pelczar.
2. Pharmaceutical Microbiology. W.B. Hugo

Pharmaceutical Chemistry (Medicinal Chemistry)

Code: PT 503
Contacts: 3L+1T
Credits: 4

Prerequisites:

Students should have a fundamental knowledge of organic chemistry, biochemistry and human physiology with an emphasis on biological action and drug development.

Outcome:

This subject helps in correlating between the pharmacology of a disease and its mitigation or cure. This also acts as a stepping stone for use of sophisticated analytical and computational tools by the students.

Syllabus Content:

1. Basic Principles of Medicinal Chemistry : Physico-chemical aspects (Optical, geometric and bio-isosterism) of drug molecules and biological action, Drug-receptor interaction including transduction mechanisms.
2. Synthetic procedures of selected drugs : Mode of action, uses, structure activity relationship including physico-chemical properties of the following classes of drugs :
Drugs acting at Synaptic and neuro-effector junction sites :
 - i) Cholinergics and Anti-cholinesterases
 - ii) Adrenergic drugs
 - iii) Antispasmodic and anti-ulcer drugs
 - iv) Neuromuscular blocking agents.
3. Concept of QSAR and descriptors, statistical loop for QSAR, classical QSAR (Hansch and free-wilson methods), CADD, Receptor based drug design like cyproheptadine HCL, paracetamol, diclofenac sodium, ibuprofen and analgin.
4. Synthetic procedures of selected drugs : Mode of action, uses, structure activity relationship including physicochemical properties of the following classes of drugs :
 - a) Autocoids
 - i) Antihistamines
 - ii) Eicosanoids
 - iii) Analgesic-antipyretics, anti-inflammatory (non-steroids) agents.
 - b) Drugs affecting uterine motility :
Oxytocics (including oxytocin, ergot alkaloids and prostaglandins)
Biochemical approaches in drug designing wherever applicable should be discussed.

Reference Books:

1. Foye's Principle of Medicinal Chemistry. Edited by T.L. Lemke.
2. Wilson and Gisvold's Textbook of organic medicinal and Pharmaceutical Chemistry. Edited by J.H. Block
3. Medicinal Chemistry: An Introduction. G. Thomas
4. An introduction to medicinal Chemistry. G.L. Patrick

Pharmaceutical Chemistry (Medicinal Chemistry)

Practical

Code: PT 593
Contacts: 3
Credits: 2

Prerequisites:

The students should have a theoretical knowledge of the synthetic procedures of cholinergic, anticholinergic, adrenergic, adrenergic blocker, anti-ulcer, anti-inflammatory, analgesic, antipyretic and other groups of drugs along with a practical knowledge of organic chemistry.

Outcome:

This subject helps in correlating between the pharmacology of a disease and its mitigation or cure. This also acts as a stepping stone for use of sophisticated analytical and computational tools by the students.

Syllabus Content:

1. Synthesis of selected drugs from the course content (at least 3 experiments).
2. Establishing the pharmacopoeial standards of the drugs synthesized.
3. Special analysis of some selected drugs from the course content like cyproheptadine HCL, paracetamol, Diclofenac sodium, Ibuprofen and Analgin

Reference Books:

1. Foye's Principle of Medicinal Chemistry. Edited by T.L. Lemke.
2. Wilson and Gisvold's Textbook of organic medicinal and Pharmaceutical Chemistry. Edited by J.H. Block
3. Vogel's textbook of practical organic chemistry. Edited by B. S. Furniss.

Pharmaceutical Chemistry (Biochemistry)

Theory

Code: PT 504
Contacts: 3
Credits: 3

Prerequisites:

The students should have a clear understanding of physiology, and chemical basis of carbohydrates, lipids and other biomolecules and heterocyclic compounds.

Outcome:

The replication, transcription and translation processes are dealt in detail. This knowledge helps and prepares them in understanding Biotechnology.

Syllabus Content:

1. Hormones : Pituitary gland, Thyroid gland and hormones secreted from pancreas
2. Metabolism of Ammonia and Nitrogen Containing Monomers : Nitrogen balance, bio-synthesis of amino acid, catabolism of amino acids (phenyl alanine methionine, histidine, alanine protein glycine) Conversion of amino acids to specialised products, Assimilation of ammonia, Urea cycle, metabolic disorders of urea cycle, Metabolism of sulphur containing amino acids, Porphyrin biosynthesis, formation of bile pigments, hyperbilirubinemia, Purine biosynthesis, Purine nucleotide interconversion, Pyrimidine biosynthesis, and Formation of deoxyribonucleotides.
3. Biosynthesis of Nucleic Acids : Brief introduction of genetic organization of the mammalian genome, alteration and rearrangements of genetic material, Biosynthesis of DNA and its replication, Mutation, Physical & chemical mutagenesis/carcinogenesis, DNA repair mechanism, Biosynthesis of RNA (Transcription) and Post transcriptional modifications.
4. Vitamins : Water and fat soluble vitamins
5. Genetic Code and Protein Synthesis : Genetic code, Components of protein synthesis, and Inhibition of protein synthesis, post translational modifications and distribution of protein of different organelles, Brief account of genetic engineering and polymerase chain reactions.
6. Regulation of gene expression.

Reference books:

1. Harper's illustrated biochemistry. R.K. Murray
2. Outline of Biochemistry. E. E. Conn.
3. Lehninger's Principles of biochemistry. D.L. Nelson

Pharmaceutical Engineering

Theory

Code : PT 507

Contact : 3

Credits: 3

Prerequisites:

The student must have the concept of size reduction, size separation, mixing, crystallization, heat transfer and should know the operations and functions of the equipments used for these processes

Course Outcome:

The students learn about different unit operations and process controls that are employed in the pharmaceutical industry. It prepares them to work in a pharmaceutical manufacturing unit.

Contents Of The Syllabus:

- Molecular Diffusion and Interphase Mass Transfer: Molecular diffusion in gas and liquid systems. Introduction to interphase mass-transfer, mathematical problems
- Distillation: Batch distillation, rectification of binary mixtures, bubble cap, sieve plate and packed bed columns, design method of plate columns, steam, vacuum, molecular and azeotropic distillations, problems (Mathematical problems)
- Extraction: Solvent extraction (liquid-liquid) and leaching, parallel current and cross-treatment method, equipments like batch extractor, centrifugal extractor, continuous leacher etc. problems (mathematical problems)
- Drying : Mechanism of drying, theory of drying, concept of EMC, CMC, FMC, drying rate curves, drying problems, pharmaceutical dryers like tray, vacuum, rotary, fluidized-bed, pneumatic, spray, freeze and infrared dryers, mathematical problems.
- Humidification and Refrigeration: Dry and wet bulb thermometry, Psychometric chart, humidity measurement, Equipments for humidification and dehumidification, pharmaceutical application and mathematical problems, principles of refrigeration, units of refrigeration, refrigerants, application in pharmacy.
- Process control system: Basic instrumentation and control in pharmaceutical industries, measurement of temperature, pressure, flow rate, humidity, vacuum and level by automatic process control systems.

Reference Books:

1. Introduction to chemical engineering, Badger, Walter L.
2. Unit operations of chemical engineering, McCabe, Warren L.
3. Chemical process principles: material and energy balances, Part 1, Hougen, O. A.
4. Unit operations of chemical engineering: mechanical operations, Vol. 1, Hiremath, R. S.

Pharmaceutical Engineering

Practical

Code: PT 597
Contacts: 3P Credits:
2

Prerequisites:

The student must have the concept of size reduction, size separation, mixing, crystallization, heat transfer and should know the operations and functions of the equipments used for these processes

Course Outcome:

The students learn about different unit operations and process controls that are employed in the pharmaceutical industry. It prepares them to work in a pharmaceutical manufacturing unit.

Syllabus Content:

1. Measurement of flow of fluids and their pressure, determination of Reynold's number and calculation of Frictional losses.
2. Evaluation of filter media, determination of rate of filtration and study of factors affecting filtration.
3. Determination of humidity – use of Dry Bulb and Wet Bulb.
4. Determination of overall heat transfer co-efficient.
5. Determination of rate of evaporation.
6. Determination of rate of drying, free moisture content and bound moisture content.
7. Experiments to illustrate principles of size reduction, Laws governing energy and power requirements of size Reduction.
8. Experiments on batch distillation and to verify Reileigh's equation, study of the performance of different dryers.

Reference Books:

1. Introduction to chemical engineering, Badger, Walter L.
2. Unit operations of chemical engineering, McCabe, Warren L.
3. Chemical process principles: material and energy balances, Part 1, Hougen, O. A.
4. Unit operations of chemical engineering: mechanical operations, Vol. 1, Hiremath, R. S.

Pharmaceutical Chemistry (Medicinal Chemistry)

Theory

Code: PT 603

Contacts: 3L+1T

Credits: 4

Prerequisites:

Students should have a fundamental knowledge of medicinal chemistry, drug receptor interaction, organic chemistry, biochemistry and human physiology and significance of drug development.

Outcome:

The mode of action, structural correlation and use of different cardioactive classes of drugs along with steroids are taught to the students. This helps them in understanding the pharmacology of these processes.

Syllabus Content:

Synthetic procedures of selected drugs, mode of action, uses, structure activity relationship including Physico-Chemical properties of the following classes of drugs :

1. Drugs acting on the Central Nervous System : General Anesthetics, Local Anesthetics, Hypnotics and Sedatives, anti-convulsants, Antiparkinsonism drugs, Antipsychotic, antidepressants, Anti-platelet and antihyperlipidemics.
2. Diuretics, Cardiovascular drugs (anti-anginal, antirhythmic, antihypertensive, anticoagulant.
3. Steroids and related drugs : Steroidal nomenclature and stereochemistry, androgens and anabolic agents, estrogens and progestational agents, adrenocorticoids.
4. Alkaloids – Definition, general identification test, determination of functional group and structure elucidation of Atropin and Ephedrine

Reference Books:

1. Foye's Principle of Medicinal Chemistry. Edited by T.L. Lemke.
2. Wilson and Gisvold's Textbook of organic medicinal and Pharmaceutical Chemistry. Edited by J.H. Block
3. Medicinal Chemistry: An Introduction. G. Thomas
4. An introduction to medicinal Chemistry. G.L. Patrick

Pharmaceutical Chemistry (Medicinal Chemistry)

Practical

Code: PT 693

Contacts: 3

Credits: 2

Prerequisites:

Students should be aware of the theoretical synthetic procedures of drugs acting central nervous system, cardiovascular drugs. They should have an analytical knowledge of assay of different drugs.

Outcome:

The mode of action, structural correlation and use of different cardioactive classes of drugs along with steroids are taught to the students. This helps them in understanding the pharmacology of these processes.

Syllabus Content:

1. Workshop on stereomodel use of some selected drugs.
2. Synthesis and identification of selected compounds from the course content (Benzil, Benzillicacid, Diphenyl hydantoin, Benzocaine).
3. Assay of some selected drug formulation from the course content (Propranolol HCL, warfarin sodium, verapamil hydrochloride, chlordiazepoxide, spironolactone, diazepam) (any four).

Reference Books:

1. Foye's Principle of Medicinal Chemistry. Edited by T.L. Lemke.
2. Wilson and Gisvold's Textbook of organic medicinal and Pharmaceutical Chemistry. Edited by J.H. Block
3. Vogel's textbook of practical organic chemistry. Edited by B. S. Furniss.

Pharmaceutics (Pharmaceutical Technology)

Theory

Code : PT 606

Contact : 3

Credits: 3

Prerequisites:

The student must have the knowledge of different types of drug delivery system and should know the manufacturing of different pharmaceuticals. He/ she should have the knowledge of handling different instruments.

Course Outcome:

The dosage form design is introduced to the students. This enables them to work in the pharma Formulation and Development.

Contents Of The Syllabus:

- Parenteral Products :
 - Pre-formulation factors, routes of administration, water for injection, pyrogenicity, non-aqueous vehicle, isotonicity and methods of its adjustment.
 - Formulation details; containers, closures and their selections.
 - Pre-filling treatment, washing of containers and closures, preparation of solution and suspension, filling and closing of ampoules, vials, infusion fluids, lyophilization and preparation of sterile powders, equipment for large scale manufacture and evaluation of parenteral products.
 - Aseptic Techniques : source of contamination and methods of prevention, design of aseptic area, laminar flow bench services and maintenance.
 - Sterility testing of pharmaceuticals.
- Surgical Products : Definition, primary wound dressing, absorbents, surgical cotton, surgical gauze etc., bandages, adhesive tape, protective cellulosic hemostatics, official dressing, absorbable and non-absorbable sutures, ligatures and catguts, preparation and sterilization of surgical catguts.
- Packaging of Pharmaceutical Products : Packaging components, types, specifications and methods of evaluation, stability aspect of packaging, packaging equipment, factors influencing choice of containers, legal and other official requirements for containers, packaging testing.
- Novel drug delivery system : Introduction to novel drug delivery systems like micro-capsule and micro-pellet parenteral and implantable therapeutic systems, transdermal therapeutic systems, micro-particulate drug carrier system, micro-encapsulation – types, method of preparation and
- evaluation.

Reference Books:

1. Modern pharmaceutics, Banker, Gilbert S.
2. Ansel's pharmaceutical dosage forms and drug delivery system, Allen, Loyd V.
3. Controlled drug delivery: fundamentals and applications, Edited by Robinson, Joseph R
4. Pharmaceutical dosage forms, Vol. 1, 2 and 3: parental medications, Edited by Avis, Kenneth E.

Pharmaceutics (Pharmaceutical Technology)

Practical
Code: PT 696
Contacts: 3
Credits: 2

Prerequisites:

The student must have the knowledge of different types of drug delivery system and should know the manufacturing of different pharmaceuticals. He/ she should have the knowledge of handling different instruments.

Course Outcome:

The dosage form design is introduced to the students. This enables them to work in the pharma Formulation and Development.

Contents Of The Syllabus:

1. Preparation of a sustained release oral dosage form and its evaluation
2. Evaluation of materials used in pharmaceutical packaging.
3. Paraffin gauze dressings.

Reference Books:

1. Modern pharmaceutics, Banker, Gilbert S.
2. Ansel's pharmaceutical dosage forms and drug delivery system, Allen, Loyd V.
3. Controlled drug delivery: fundamentals and applications, Edited by Robinson, Joseph R
4. Pharmaceutical dosage forms, Vol. 1, 2 and 3: parental medications, Edited by Avis, Kenneth E.

Pharmaceutics (Biopharmaceutics And Pharmacokinetics)

Theory

Code : PT 611

Contact : 3L + 1T = 4

Credits: 4

Prerequisites:

The student must have the knowledge of basic concepts for developments of various novel drug delivery systems, capable of controlling the rate of drug delivery, sustaining the duration of therapeutic activity and to check the stability of the formulations.

Course Outcome:

This subject enables the students to visualize the effect of pharmacokinetic (ADMET) parameters on the biological effect of the drug. The correlation of pharmacokinetics and pharmacodynamics is thus introduced and is experimentally explained to them.

Contents Of The Syllabus:

- Introduction to Biopharmaceutics and Pharmacokinetics and their role in formulation development and clinical setting.
- Biopharmaceutics :
 1. Passage of drugs across biological barrier (passive diffusion, active transport, facilitated diffusion and pinocytosis)
 2. Factors influencing absorption-Physicochemical, physiological and pharmaceutical.
 3. Drug distribution in the body, plasma protein binding.
- Bioavailability and bioequivalence :
 - a) Measures of bioavailability, C_{max} , t_{max} and area under the curve (AUC).
 - b) Design of single dose bio-equivalence study and relevant statistics.
 - c) Review of regulatory requirements for conduction of bio-equivalent studies.
- Pharmacokinetics :
 - a) Significance of plasma drug concentration measurement
 - b) Compartment model-Definition and Scope
 - c) Pharmacokinetics of drug absorption-Zero order and first order absorption rate constant using Wagner – Nelson and Loo-Reigelman method.
 - d) Volume of distribution and distribution coefficient.
 - e) Compartment kinetics-One compartment and two compartment models. Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.
 - f) Curve fitting(method of Residuals), regression procedures.
 - g) Clearance concept, Mechanism of renal clearance, clearance ratio, determination of renal clearance.
 - h) Extraction ratio, hepatic clearance, biliary excretion, Extrahepatic circulation.
 - i) Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration, Michaelis Menten Equation, detection of non-linearity (Saturation mechanism).
- Clinical Pharmacokinetics :
 - a) Definition and scope
 - b) Dosage adjustment in patients with and without renal and hepatic failure.
 - c) Design of single dose bio-equivalence study and relevant statistics.
 - d) Pharmacokinetic drug interactions and their significance in combination therapy.

Reference Books:

1. Biopharmaceutics and clinical pharmacokinetics, Gilbadi, Milo
2. Biopharmaceutics biochemistry and biotechnology, Walsh, Gary
3. Clinical pharmacokinetics: concepts and applications, Rowland, Malcolm.

Pharmaceutics (Biopharmaceutics And Pharmacokinetics)

Practical

Code: PT 697
Contacts: 3P
Credits: 2

Prerequisites:

The student must have the knowledge of basic concepts for developments of various novel drug delivery systems, capable of controlling the rate of drug delivery, sustaining the duration of therapeutic activity and to check the stability of the formulations.

Course Outcome:

This subject enables the students to visualize the effect of pharmacokinetic (ADMET) parameters on the biological effect of the drug. The correlation of pharmacokinetics and pharmacodynamics is thus introduced and is experimentally explained to them.

Syllabus Content:

1. Analysis of biological specifications for drug content and estimation of the pharmacokinetic parameters.
2. In vitro evaluation of different dosage forms for drug release.
3. Absorption studies – in vitro
4. Statistical treatment of pharmaceutical data.

Reference Books:

1. Biopharmaceutics and clinical pharmacokinetics, Gilbadi, Milo
2. Biopharmaceutics biochemistry and biotechnology, Walsh, Gary
3. Clinical pharmacokinetics: concepts and applications, Rowland, Malcolm.

Pharmacology

Theory

Code: PT-608

Contact: 3

Credits: 3

Prerequisites:

The student must have some basic command of Physiology and Chemistry, and General pharmacology.

Course Outcome:

The pharmacology and correlation with medicinal chemistry to different cardioactive agents and steroids are introduced.

Contents Of The Syllabus:

1. Pharmacology of Cardiovascular System :
 - a) Digitalis and cardiac glycosides
 - b) Antihypertensive drugs
 - c) Anti-anginal and Vasodilator drugs
 - d) Anti-arrhythmic drugs
 - e) Anti-hyperlipedemic drugs
 - f) Drugs used in the therapy of shock
2. Drugs Acting on the Hemopoetic System :
 - a) Hematinics
 - b) Anticoagulants, Vitamin K and hemostatic agents.
 - c) Fibrinolytic and anti-platelet drugs
3. Bioassay: Definition; merits and demerits threshold dose bracketing, four point and other assay; bioassay of acetylcholine, hydroxytryptamine, adrenaline, noradrenaline, sedative agents, oxytocin, digitalis, different hormones, local anesthetics, etc.
4. Drugs acting on urinary system :
 - a) Fluid and electrolyte balance
 - b) Diuretics
5. Autocoids:
 - a) Histamine, 5-HT and their antagonists
 - b) Prostaglandins, thromboxanes and leukotrienes
6. Drugs Acting on the Respiratory System :
 - a) Anti-asthmatic drugs including bronchodilators
 - b) Anti-tussives and expectorants

Reference Books:

1. Essentials of medical pharmacology , Tripathi, K. D
2. Lippincott's illustrated reviews: pharmacology , Edited by Finkel, Richard.
3. Clinical pharmacology, Bennett, P. N.
4. Screening Methods in Pharmacology volume: I, Robert H. Turner.
5. Screening Methods in Pharmacology volume: II, Robert H. Turner

Pharmacology

Practical

Code: PT 698
Contacts: 3
Credits: 2

Prerequisites:

The student must have some basic command of Physiology and Chemistry, and General pharmacology.

Course Outcome:

. The pharmacology and correlation with medicinal chemistry to different cardioactive agents and steroids are introduced.

Syllabus Content:

1. Experiments on intact preparations :
Study of different routes of administration of drugs in mice/rats.
2. Experiments on Central Nervous system :
Recording of spontaneous motor activity, stereotype, analgesia, anticonvulsant activity, and
inflammatory activity and muscle relaxant activity of drugs using simple experiments.
3. Effects of autonomic drugs on rabbit's eye :
4. Effects of various agonists and antagonists and their characterization using isolated preparations like frog's rectus abdominis muscle and isolated ileum preparations of rat guinea pig and rabbit.
5. Experiments on Isolated Preparations : (at least three)
 - a) To record the concentration response curve (CRC) of acetylcholine using rectus abdominis muscle preparation of frog.
 - b) To study the effects of physostigmine and d-tubocurarin on the CRC of acetylcholine using rectus abdominis muscle preparation of frog.
 - c) To record the CRC of 5-HT on rat uterus preparation.
 - d) To record the CRC of histamine on guineapig ileum preparation
 - e) To record the CRC of noradrenaline on rat anococcygeus muscle preparation. f) To record the CRC of oxytocin using rat uterus preparation
6. Abnormal toxicity test (Phenol)

Reference Books:

1. Essentials of medical pharmacology , Tripathi, K. D
2. Lippincott's illustrated reviews: pharmacology , Edited by Finkel, Richard.
3. Clinical pharmacology, Bennett, P. N.
4. Screening Methods in Pharmacology volume: I, Robert H. Turner.
5. Screening Methods in Pharmacology volume: II, Robert H. Turner

Pharmaceutical Biotechnology And Industrial Microbiology

Theory

Code: PT 609

Contacts: 3

Credits: 3

Prerequisites:

The students must have knowledge on microbiology, organic chemistry and biochemistry.

Outcome:

Pharmaceutical biotechnology introduces the concepts like rDNA technology, site directed mutagenesis to the students and thereby also helps in their further learning and project planning.

Syllabus Content:

1. Immunology and Immunological Preparations : Principles, antigens and Haptens, Immune system, cellular humoral immunity, immunological tolerance, antigen-antibody reactions and their applications. Hypersensitivity, active and passive immunization, Vaccines – preparation, standardization and storage.
2. Genetic Recombination : Microbialgenetics & variation, Transformation, conjugation, transduction, protoplast fusion and gene cloning and their applications, Development of hybridoma for monoclonal antibodies, Study of drugs produced by biotechnology such as Activase, Humulin, Humatrope, HB etc
3. Antibiotics : Historical development of antibiotics, Antimicrobial spectrum and methods used for their standardization, Screening of soil for organisms producing antibiotics, fermenter, its design, control of different parameters. Isolation of mutants, factors influencing rate of mutation. Design of fermentation process. Isolation of fermentation products with special reference to penicillins, streptomycins tetracyclines and vitamin B12.
4. Microbial Transformation : Introduction, types of reactions mediated by microorganisms, design of biotransformation processes, selection of organisms, biotransformation process and its improvements with special reference to steroids.
5. Enzyme immobilization : Techniques of immobilization of enzymes, factors affecting enzyme kinetics. Study of enzymes such as hyaluronidase, penicillinase, streptokinase and streptodornase, amylases and proteases etc. Immobilization of bacteria and plant cells.
6. Fermentative Production of alcohol

Reference books:

1. Prescott and Dunn's Industrial Microbiology. Edited by G. Reed.
2. Principles of gene manipulation and genomics. S.B. Primerose
3. Lewins Gene IX. J. E. Krebs.

Pharmaceutics (Pharmaceutical Technology)

Theory

Code : PT 706

Contact : 3

Credits: 3

Prerequisites:

The student must have the knowledge of different types of drug delivery system and should know the manufacturing of different pharmaceuticals. He/ she should have the knowledge of handling different instruments.

Course Outcome:

The preparation and evaluation of novel drug delivery systems is imparted on the students on a practical and theoretical basis. This enables them to think while in an F&D project in their further life.

Contents Of The Syllabus:

- Preformulation Studies :
 - a) Introduction, qualification of preformulators, microscopy, thermal analysis, x-ray polymorphism, hygroscopicity, density, powder flow, solubility, Pka, P-C dissolution.
 - b) Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc. and their influence on formulation and stability of products.
 - c) Study of pro-drugs in solving problems related to stability bio-availability and elegance of formulations.
- Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets, suspensions.
- Stabilization and stability testing protocol for various pharmaceutical products.
- Performance evaluation methods :
- In vitro dissolution studies for solid dosage forms method interpretation of dissolution data.
- GMP and quality assurance, Quality audit.
- Principle, production and evaluation of oral controlled released formulations.

Reference Books:

1. Drug stability: principles and practices, Carstensen, Jens T.
2. Good manufacturing practices for pharmaceuticals, Nally, Joseph D.
3. Pharmaceutical process validation, Edited by Nash, Robert A.
4. The theory and practice of industrial pharmacy, Lachman, Leon
5. Physiochemical principles of pharmacy, Florence, A. T.
6. Controlled drug delivery: fundamentals and applications, Edited by Robinson, Joseph R.

Pharmaceutics (Pharmaceutical Technology)

Practical

Code: PT 796

Contacts: 3

Credits: 2

Prerequisites:

The student must have the knowledge of different types of drug delivery system and should know the manufacturing of different pharmaceuticals. He/ she should have the knowledge of handling different instruments.

Course Outcome:

The preparation and evaluation of novel drug delivery systems is imparted on the students on a practical and theoretical basis. This enables them to think while in an F&D project in their further life.

Contents Of The Syllabus:

1. Dissolution testing and data evaluation for oral solid dosage forms.
2. Design, development and evaluation of controlled release formulations.

Note: At least seven experiments to be performed

Reference Books:

1. The theory and practice of industrial pharmacy, Lachman, Leon

Pharmaceutical Chemistry (Medicinal Chemistry)

Theory

Code: PT 703

Contacts: 3L+1T

Credits: 4

Prerequisites:

Successful completion of all Semester 6 courses of B. Pharm as per WBUT syllabus. Students should have a fundamental knowledge of drug receptor interaction, organic chemistry, biochemistry, human physiology, microbiology and significance of drug development.

Outcome:

The chemotherapy for cancer and microbial diseases and different antihyperglycemic agents is given to the students. This gives them knowledge on the thrust areas for further research.

Syllabus Content:

Structure, Synthetic procedures uses of the selected drugs and mode of action of the following classes of drugs :- ,

1. Anti-biotics & Chemotherapeutic agents : -lactam, chloramphenicol, macrolides, aminoglycosides, Macrolides, Chloramphenicol, Anthelmintic Fluoroquinolones, Antiviral, antimalarial, Antifungal, Antimaebic, Antileprotic and Antitubercular drugs).
2. Antineoplastic agents
3. Thyroid and anti-thyroid drugs
4. Insulin and oral hypoglycaemic agents

Reference Books:

1. Foye's Principle of Medicinal Chemistry. Edited by T.L. Lemke.
2. Wilson and Gisvold's Textbook of organic medicinal and Pharmaceutical Chemistry. Edited by J.H. Block
3. Medicinal Chemistry: An Introduction. G. Thomas

Pharmaceutical Chemistry (Medicinal Chemistry)

Practical

Code: PT 793

Contacts: 3

Credits: 2

Prerequisites:

Students should be aware of the theoretical synthetic procedures of drugs acting chemotherapeutic agents, antimicrobial agents. They should have an analytical knowledge of assay of different drugs.

Outcome:

The chemotherapy for cancer and microbial diseases and different antihyperglycemic agents is given to the students. This gives them knowledge on the thrust areas for further research.

Syllabus Content:

1. Synthesis of any three selected drugs (e.g. sulphacetamide, ethambutol, PABA, Isonicotinic acid etc.,)
2. Pharmacopoeial assay of any four selected drugs (any three) formulations (Chlorpropamide, Albendazole, Metformin HCL, Rifampicin, Trimethoprim).

Reference books:

1. Foye's Principle of Medicinal Chemistry. Edited by T.L. Lemke.
2. Wilson and Gisvold's Textbook of organic medicinal and Pharmaceutical Chemistry. Edited by J.H. Block
3. Vogel's textbook of practical organic chemistry. Edited by B. S. Furniss.

Pharmacognosy

Code: PT 702
Contacts: 3
Credits: 3

Prerequisites:

Basic knowledge of Pharmacognosy which students have learnt in second semester and fourth semester is essential to understand the content of the syllabus. Along with the basic knowledge of Pharmacognosy, students must have a knowledge of Organic Chemistry, basic chemistry of Heterocyclic compounds, biochemistry and reaction mechanisms are essential. Knowledge of pharmaceutical formulation, cosmetics, biotechnology and microbiology are also important prerequisite for the content of the syllabus.

Course Outcome:

The biosynthesis of different plant secondary metabolites are introduced to the students. This helps them in identifying biomolecules as pharmacophores and correlate this knowledge with medicinal chemistry and pharmacology.

Contents Of The Syllabus:

1. Biogenesis and pharmacological activity of medicinally important monoterpenes, sesquiterpenes, diterpenes and triterpenoids.
2. Carotenoids : -carotenoids, -carotinoids, Vitamin A, Xanthophylls of medicinal importance.
3. Glycosides : Chemistry and bio-synthesis of digitoxin, digoxin, hecogenin, sennosides, diosgenin and sarasapogenin.
4. Alkaloids : Chemistry, biogenesis and pharmacological activity of atropine and related compounds; quinine, reserpine, morphine, papaverine, ephedrine, ergot and vinca alkaloids, general method for isolation of alkaloids.
5. Historical development of plant tissue culture, types of cultures, nutritional requirements, growth and their maintenance, Applications of plant tissue culture in pharmacognosy.
6. Marine pharmacognosy, novel medicinal agents from marine sources.
7. Cultivation, collection, identification, preservation of important medicinal plants and herbs
8. Screening of flavonoids and polyphenols in plant extracts.
9. Basic metabolic pathways and biogenetics of secondary metabolites of pharmaceutical importance.
10. Herbal cosmetics

Reference Books:

1. Kokate, Gokhale, Purohit; Pharmacognosy
2. Evans W.C, Trease and Evans' Pharmacognosy
3. Wallis TE; Textbook of Pharmacognosy

Pharmacology

Theory

Code : PT-708

Contact : 3

Credits: 3

Prerequisites:

The student must have some basic command of Physiology and Chemistry, and General pharmacology.

Course Outcome:

The pharmacology of different endocrine and gastrointestinal systems is introduced to the students thereby helping them to correlate between diseases and their cures.

Contents Of The Syllabus:

1. Pharmacology of Endocrine System:
 - a) Hypothalamic and pituitary hormones
 - b) Thyroid hormones and anti-thyroid drugs, calcitonin.
 - c) Insulin, oral hypoglycaemic agents & glucagon
 - d) ACTH and corticosteroids
 - e) Androgens and anabolic steroids
 - f) Estrogens, progesterone and oral contraceptives.
 - g) Drugs acting on the uterus.

2. Chemotherapy ;
 - a) General Principles of Chemotherapy
 - b) Sulfonamides and cotrimoxazole
 - c) Antibiotics-Penicillins, Cephalosporins, Chloramphenicol, Erythromycin, Quinolones and Miscellaneous Antibiotics.
 - d) Chemotherapy of tuberculosis, leprosy, fungal diseases, viral diseases, urinary tract infections and sexually transmitted diseases.
 - e) Chemotherapy of malignancy and Immunosuppressive Agents

3. Drugs Acting on the Gastrointestinal Tract :
 - a) Antacids, Anti Secretory and Anti-ulcer drugs
 - b) Laxatives and anti-diarrhoeal drugs.

- c) Emetics and anti-emetics.

Reference Books:

1. Essentials of medical pharmacology , Tripathi, K. D
2. Lippincott's illustrated reviews: pharmacology , Edited by Finkel, Richard.
3. Clinical pharmacology, Bennett, P. N.
4. Screening Methods in Pharmacology volume: I, Robert H. Turner.
5. Screening Methods in Pharmacology volume: II, Robert H. Turner.

Pharmaceutical Industrial Management

Theory
Code: PT 812
Contacts: 3
Credits: 3

Prerequisite:

The student should have good knowledge of mathematics, good communication skills.

Outcome:

They develop and managerial skills as well as the gain the knowledge of accountancy needed on a day to day basis for running and managing a pharmacy.

Syllabus content:

1. Concept of Management : Administrative Management (Planning, Organizing, Staffing, Directing and Controlling), Entrepreneurship development, Operative Management (Personnel, Materials, Production, Financial, Marketing, Time/space, Margin/Morale). Principles of Management (Co-ordination, Communication, Motivation, Decision-making, leadership, Innovation, Creativity, Delegation of Authority/Responsibility, Record Keeping). Identification of Key points to give maximum thrust for development and perfection.
2. Accountancy : Principles of Accountancy, Ledger posting and book entries, preparation of trial balance, columns of a cash book, Bank reconciliation statement, rectification of errors, Profits and loss account, balance sheet, purchase, keeping and pricing of stocks, treatment of cheques, bills of exchange, promissory notes and hundies, documentary bills.
3. Economics : Principles of economics with special reference to the laws of demand and supply, demand schedule, demand curves, labour welfare, general principles of insurance and inland and foreign trade, procedure of exporting and importing goods.
3. Pharmaceutical Marketing : Functions, buying, selling, transportation, storage, finance, feedback, information, channels of distribution, wholesale, retail, departmental store, multiple shop and mail order business.
5. Salesmanship : Principles of sales promotion, advertising, ethics of sales, merchandising, literature, detailing, Recruitment, training, evaluation, compensation to the pharmacist.
7. Market Research :
 - a) Measuring & Forecasting, Market Demands, Major conception, demand measurement, Estimating current demand, Geo-demographic analysis, Estimating industry sales, Market share & Future demand.
 - b) Market Segmentation & Market Targeting.
8. Materials Management : A brief exposure or basic principles of materials management-major areas, scope, purchase, stores, inventory control, an evaluation of material management.
9. Production Management : A brief exposure of the different aspects or Production, Management-Visible and Invisible inputs, Methodology of Activities. Performance Evaluation Technique, Process-Flow, Process Know-how, Maintenance Management.
10. Personal Management
11. Concept of GLP, ISO 9000 and TQM

Reference Books:

1. Marketing Management. Phillip Kotler.

2. Organizational Behaviour. S.P. Robbins.

3. Cost and Management Accounting. S.P. Basu.

Pharmaceutical Analysis

Theory

Code: PT 801

Contacts: 3L

Credits: 3

Prerequisites:

Students should have a basic knowledge of different analytical (aqueous, non-aqueous, chromatographic) and instrumental (potentiometric, conductometric) procedures of different drug molecules.

Outcome:

The instrumental methods of analysis that are required in pharmaceutical research are covered in this course. The practical application of these instruments are also illustrated to the students

Syllabus Content:

following analytical techniques would be discussed :

1. Ultraviolet and visible spectrophotometry
2. Fluorimetry
3. Infrared spectrophotometry(FT-IR – an introduction)
4. Flame Photometry
5. Nuclear Magnetic Resonance Spectroscopy
6. Mass-spectrometry
7. Atomic Absorption spectroscopy
8. Radio immunoassay

Reference Books:

1. Instrumental methods of analysis. H.H. Willard.
2. Instrumental methods of chemical Analysis. G.R. Chatwal.
3. Organic Spectroscopy. W. Kemp.

Pharmaceutical Analysis

Practical

Code: PT 891
Contacts: 3
Credits: 2

Prerequisites:

Students should have previous experience of handling analytical instruments like colorimeter, pH meter, UV-spectrophotometer, refractometer, polarimeter etc.

Outcome:

The instrumental methods of analysis that are required in pharmaceutical research are covered in this course. The practical application of these instruments are also illustrated to the students

Syllabus Content:

1. Quantitative estimation as per pharmacopoeial method of at least seven formulations containing single drug or more than one drug, using instrumental techniques
2. Estimation of Na^+ , K^+ , Ca^{++} ions using flame photometry.

Reference books:

1. Instrumental methods of chemical Analysis. G.R. Chatwal.

Pharmaceutical Jurisprudence & Ethics

Theory

Code: PT 813

Contacts: 3

Credits: 3

Prerequisites:

The student must have good logical understanding abilities and good communication skills.

Outcomes:

The different laws that governs that different aspects of pharmacy are introduced to the students. This builds up their fundamental knowledge on the ethics associated with the profession of pharmacy

Syllabus Content:

1. Introduction
Pharmaceutical legislation – A brief review.
2. An elaborate (practical oriented) study of the following
 - a) Pharmaceutical Ethics
 - b) Pharmacy Act 1948
 - c) Drugs and Cosmetics Act 1940 and Rules 1945
3. An elaborate (practical oriented) study of the following
 - d) Medicinal & Toilet Preparations(Excise Duties) Act 1955
 - e) Narcotic Drugs & Psychotropic Substances Act 1955 & Rules
 - f) Drugs Price Control Order.
4. A brief study of the following with special reference to the main provisions.
 - a) Drugs and Magic Remedies(Object Advertisements Act 1954)
 - b) Medical Termination of Pregnancy Act 1970 & Rules 1975.
 - c) Prevention of Cruelty to Animals Act 1960.
 - d) States Shops & Establishments Act & Rules.
 - e) Factories Act 1948.
 - f) Patents Act (latest)

Note: The teaching of all the above Acts should cover the latest amendments.

Reference books:

1. The Drug and cosmetic Act, 1940. V. Malik
2. Laws relating to drugs and cosmetics. V.Malik.

Hospital & Clinical Pharmacy

Theory

Code: PT 818

Contacts: 3

Credits: 3

Prerequisites:

The student must be well acquainted with microbiology, pharmacology, toxicology and pharmacokinetics

Outcome:

This course deals majorly with the different professional aspects of pharmacy. It helps the students to develop a keen inquisitive mind that is needed by a practising pharmacist.

Syllabus Content:

Hospital pharmacy :

1. Organisation and Structure : Organisation of hospital pharmacy, Responsibilities of a hospital pharmacist, Pharmacy and therapeutic committee.
2. Hospital Formulary : Contents, preparation and revision of hospital formulary.
3. Drug distribution Systems in Hospitals :
 - a) Out-patient dispensing, methods adopted.
 - b) Dispensing of drugs to in-patients. Types of drug distribution systems, Charging policy, labelling.
4. Manufacture of Sterile and Nonsterile Products : Policy making of manufacturable items, demand and costing, personnel requirements, manufacturing practice. Master formula Card, production control, Manufacturing records.

Clinical Pharmacy

1. Introduction to Clinical Pharmacy.
2. Important Disorders of Organ Systems and their Management :
 - a) Cardiovascular Disorders-Hypertension, Congestive Heart Failure, Angina, Acute Myocardial Infraction, Cardiac arrhythmia.
 - b) CNS Disorders : Epilepsy, Parkinsonism, Schizophrenia, Depression.
3. Basic Concepts of Pharmacotherapy.
 - a) Drug use during Pregnancy
 - b) The Basics of Drug Interactions, types of drug-drug interaction, pharmacokinetic and pharmacodynamic drug interaction, drug-food interaction.
4. Concept of Essential Drugs and Rational use of drug.
5. Basic concepts of Clinical trials – Phase-I, Phase-II, Phase-III & IV
6. Basic concept of Clinical trial monitoring

Reference books:

1. Essentials of medical pharmacology , Tripathi, K. D
2. Lippincott's illustrated reviews: pharmacology , Edited by Finkel, Richard.
3. Clinical pharmacology, Bennett, P. N.
4. Screening Methods in Pharmacology volume: I, Robert H. Turner.
5. Screening Methods in Pharmacology volume: II, Robert H. Turner.

Computer application in Pharmaceutical Technology

Elective

Paper Code :PT 610A

Contacts: 3L

Credits: 3

Prerequisite:

The student must have knowledge about softwares, programming, RDBMS and basics of drug designing.

Outcome:

After completion of this elective subject the students will be more knowledgeable in pharmacophore mapping and subsequent drug designing which will be helpful for their future research work.

Syllabus Content:

- Relational Database and SQL
- Introduction to data base, DBMS. Database versus early file keeping system, need for DBMS, Database Languages, users and administrators, Database architecture, types of databases.
- Integrity:- domain constraints and referential integrity
- Introduction to Relational Database, tables and fields,
- Relational databases design : Functional Dependencies, decomposition, 1NF, 2NF, 3NF, and BCNF Structured Query Language (SQL)
- Statistical analysis using standard package
- Linear Regression and Correlation: Introduction, Fitting lines, confidence label, Analysis of residuals, nonlinear regression. Studies of this parameter through computer package.
- Computer aided drug design:- A preliminary approach to QSAR and combinatorial chemistry,
- Use of database management system (DBMS) in clinical drug interaction and drug information services.

Reference books:

- 1.. Foye's Principle of Medicinal Chemistry. Edited by T.L. Lemke.
2. Wilson and Gisvold's Textbook of organic medicinal and Pharmaceutical Chemistry. Edited by J.H. Block
3. Medicinal Chemistry: An Introduction. G. Thomas
4. An introduction to medicinal Chemistry. G.L. Patrick

Computer Application in Pharmaceutical Technology

Practical
Paper Code :PT 691A,
Contact : 3
Credit : 2

Prerequisite:

The student must have knowledge about softwares, programming, RDBMS and basics of drug designing.

Outcome:

After completion of this elective subject the students will be more knowledgeable in pharmacophore mapping and subsequent drug designing which will be helpful for their future research work.

Syllabus Content:

Exercise based on topics like :

1. Creating and modifying table with Oracle, querying with SQL
2. Quantitative structure activity relationship
3. Data base system and use of this system using FOXPRO or Microsoft Access in clinical drug interaction and drug information services

Advanced Biotechnology

Practical
PT 691B
Contact:3
Credit:2

Prerequisites:

Students must be well versed in microbiology, biochemistry and organic chemistry.

Outcome:

The current developments in the field of biotechnology help the students to develop a clear knowledge of the research thrust areas.

Syllabus Content:

1. Protein separation by gel electrophoresis
 - a) Assembling of Electrophoresis apparatus b) Gel casting
 - c) Loading of proteins in the gel and separation according to molecular weight d) Staining of protein bands in the gel.
2. Microtechnique : Preparation of animal tissue sections for histological / histopathological / immunocytochemical studies
3. Estimation of hormone concentration from blood serum by immunoassays like ELISA
5. Extraction of
 - (a) total RNA]
 - (b) DNA] from tissue extracts
 - (c) Protein]
6. Spectrophotometric assay of enzymes
7. Estimation of
 - (a) Serum Glutamate Oxaloacetate Transaminase (SGOT) Test
 - (b) Serum Glutamate Pyruvate Transaminase (SGPT) Test
 - (c) Protein with standard curve by Ninhydrine method

Elective- I
Advanced Biotechnology

Elective
PT610B

Prerequisites:

Students must be well versed in microbiology, biochemistry and organic chemistry.

Outcome:

The current developments in the field of biotechnology help the students to develop a clear knowledge of the research thrust areas.

Syllabus Content:

1. Introduction & historical background
 - a) Scientific & Technological foundations
 - b) Micro & nano-technology for medicine

2. Bio-technology & Medicines
 - a) Vitamins
 - b) Steroids
 - c) Amino acid
 - d) Proteins
 - e) Antibiotics
 - f) Natural compounds
 - a) Gene farming
 - i) Animals
 - i) Plants

3. Recombinant DNA Technology
 - a) Concept
 - b) Cutting and rejoining of DNA
 - c) DNA segregating
 - d) PCR in gene amplification
 - e) Isolation and amplification of gene

4. Bio-informatics
 - a) Molecular pharmaceutical biotechnologyMoral and ethical questions (safety – medical, biological, chemical)

Reference Books:

1. Prescott and Dunn's Industrial Microbiology. Edited by G. Reed.
2. Principles of gene manipulation and genomics. S.B. Primerose
3. Lewins Gene IX. J. E. Krebs.
4. Bioinformatics: Sequence and genome Analysis. D.W. Mount

Packaging Technology

Elective-II

Code: (PT 709A) Contact : 3

Credit : 3

Prerequisite:

The student should have adequate knowledge on different pharmaceutical dosage forms.

Outcome:

The students will be well acquainted with the different packaging materials found in the industry and also will be able to find the suitable packaging material in case of new formulations

Syllabus Content:

Packaging of pharmaceutical dosage form

- a. Introduction, Definition and function, regulatory requirement, Nature of package evaluation
 - b. Packaging of solid oral dosage form : scope, Packaging, stability and shelf life containers and Closures, Unit dosage packaging.
 - c. Packaging of parenteral and ophthalmic: scope, regulatory requirements, containers, Closures.
 - d. Packaging of semisolids and topicals: scope, Closures and containers for different liquid and semisolid formulations, transdermal devices.
 - e. Packaging of aerosols: scope, pressurized containers, metered dose inhalers, non-pressurized containers, spray pumps, drug powder inhalers.
 - f. Influence of packaging components on dosage form stability.
1. Packaging materials science
 - a. Glass packaging materials - containers and Closures Glass as a packaging material, composition, types, manufacture of glass.
 - b. Plastic packaging materials - containers and Closures
Introduction, methods of preparation, classification of materials, Drug-plastic considerations, Selection of proper materials, drug plastic considerations, selection of proper materials.
 - c. Metal packaging materials - containers and Closures
Introduction, Modern packaging metal, Tinsplate and associated materials aluminum, Types of metal containers.
 2. Tamper – Resistant packaging
Introduction, Film Wrapper, Blister package, strip package, Bubble pack, Shrink bonding, foil, paper of plastic pouches, bottle seals, tape seals, breakable caps, sealed tubes, aerosol containers, sealed containers.
 3. Quality control and storage of packaging materials.
 4. Designing packages for disposability (Wastage control)
Packaging of pharmaceutical dosage form
 - a. Introduction, Definition and function, regulatory requirement, Nature of package evaluation
 - b. Packaging of solid oral dosage form : scope, Packaging, stability and shelf life containers and Closures, Unit dosage packaging.
 - c. Packaging of parenteral and ophthalmic: scope, regulatory requirements, containers, Closures.
 - d. Packaging of semisolids and topicals: scope, Closures and containers for different liquid and semisolid formulations, transdermal devices.
 - e. Packaging of aerosols: scope, pressurized containers, metered dose inhalers, non-pressurized containers, spray pumps, drug powder inhalers.
 - f. Influence of packaging components on dosage form stability.
 1. Packaging materials science
 - a. Glass packaging materials - containers and Closures
Glass as a packaging material, composition, types, manufacture of glass.
 - b. Plastic packaging materials - containers and Closures

Introduction, methods of preparation, classification of materials, Drug-plastic considerations, Selection of proper materials, drug plastic considerations, selection of proper materials.

c. Metal packaging materials - containers and Closures

Introduction, Modern packaging metal, Tinsplate and associated materials aluminum, Types of metal containers.

2. Tamper – Resistant packaging

Introduction, Film Wrapper, Blister package, strip package, Bubble pack, Shrink bonding, foil, paper of plastic pouches, bottle seals, tape seals, breakable caps, sealed tubes, aerosol containers, sealed containers.

3. Quality control and storage of packaging materials.

4. Designing packages for disposability (Wastage control)

Advanced Pharmacognosy

Paper code : 709B

Contact - 3 period /

week Credit : 3

Prerequisites:

Basic knowledge of Pharmacognosy which students have learnt in second semester and fourth semester is essential to understand the content of the syllabus. Along with the basic knowledge of Pharmacognosy, students must have a knowledge of Pharmaceutical analysis, Pharmaceutics, industrial pharmacy and Pharmacology are essential. Knowledge of pharmaceutical formulation, zoology, Biotechnology and microbiology are also important prerequisite for the content of the syllabus.

Course Outcome:

- Students will get knowledge of industrial application of Pharmacognosy from this course content. They will be able to standardize the crude drugs and herbal formulation and ethnomedicine along with an idea of drug discovery process from natural origin and traditional and ethnomedicine.

Contents Of The Syllabus:

1. Indigenous systems of medicines with emphasis on Ayurveda.
2. Some important techniques associated with quality control of Herbal
Drugs :-
 - a. Adulteration & deterioration
 - b. Factors affecting Herbs
quality
 - c. TLC / HPTLC
 - d. Sampling procedures
 - e. Morphological
examination
 - f. Microscopical evaluation
 - g. Chemical evaluation
3. Pharmacological Screening of herbal drugs.
4. Quality assurance & stability testing of herbal drugs.
5. Extraction of herbal
drugs
 - a. Basic
principle
 - b. Preextraction operation for crude drugs
 - c. Effect of solvent, solvent mixture & solution of
extraction
 - d. Procedure of extraction
 - e) Treatment of dry residue after extraction

Reference Books:

1. Mukherjee P.K.; Quality control of herbal drugs: an approach to evaluation of botanicals; Business Horizon
2. Vogel; Drug Discovery and Evaluation: Pharmacological Assays volume: 1 and 2

Pharmaceutical marketing management

Code: 709 C
Contact : 3 hrs. / week
Credit : 3

Prerequisites:

The student must have some basic logical skills.

Outcomes:

After completion of the course the student will be able to use logic, communication flair, and managerial skills at the workplace.

Contents of Syllabus:

Understanding of Pharmaceutical Marketing Management

Defining Marketing

- ii) Marketing Task – Demand States & Marketing task, Scope of Marketing, Different Markets.
- iii) Concept of Marketing – Definition of marketing, Distinction between marketing & Selling, Core Marketing Concept, Marketing Place, Marketing Space, Target Market, Segmentation of Market, Needs, wants & Demands, Product offering, value & satisfaction, Relationship net work, Supply chain competition, Marketing Environment, Marketing Mix (4 P Components), Other concept's name under marketing activities.

Marketing Opportunities

- 1) Market Oriented Strategic Planning – SWOT Analysis, Strategic Formulation, Product Planning,
- 2) Gathering Information & Measuring Demand – MIS, Market Research, Behavioural Research, Marketing Research, Forecasting & Demand Measurement.
- 3) Analysing Consumer Markets & Buyer Behaviour – Influencing Buyer Behaviour, Buying Decision Process, Motivation of Physician towards Brand.
- 4) Dealing With the Competition - Identifying Competitors, Analysing Competitors, Strategies, Strength & Weakness. Designing Competitive Strategies. Developing Market Strategies & Marketing Mix, Product Strategy
 - 1) Positioning & Differentiating the Market Offering (Product) - Positioning to Promote,
 - 2) Product Life Cycle marketing Strategies- Product Life Cycle
 - 3) New Market Offering – Which markets to Enter, How to Enter the Market, Product Development, Market Testing.
 - 4) Setting the Product Strategy – Product & Product Mix., Product Line analysis, Brand Decision, Packaging & Labeling.

Managing & Delivering Marketing Programs

- 1) Value Net- Work & Marketing Channels – Channel Functions, Channel Levels, Channel Management, Decisions, Selecting, Training, Motivating & Evaluating Channels Members, Channel Dynamics, Conflicts, Co- operation & Competitions.
- 2) Managing Retailing, Wholesaling & Market Logistics - Types of Retailing, Types of Wholesaling.
- 3) Managing Advertising, Sales Promotion & Public Relations - Advertising Objective, Choosing the Advertising Message, Measuring Effectiveness of Advertisement. Sales Promotion & Purpose, Public Relations.

- 4) Managing Sales Force- Recruitment & Selecting Representative, Training sales Representative, Supervising, Norms for Customer Calls, Motivating Sales representative, Evaluating Sales representative.

Reference Books:

1. Marketing Management. Phillip Kotler.
2. Organizational Behaviour. S.P. Robbins.