

15CBPH21**Pharmaceutics – II (Physical Pharmacy -II)****Course Objective:**

Physical pharmacy is a fundamental course that leads to proper understanding of subsequent courses in Pharmaceutics and pharmaceutical technology. It leads to integrates knowledge of mathematics, physics and chemistry and applies them to the pharmaceutical dosage form development. And it also provides the basis for understanding the chemical and physical phenomena that govern the in vivo and in vitro actions of pharmaceutical products.

Theory**3-0-0-3****Unit I: Micromeritics and powder rheology:****12 hrs**

Particle size and distribution, average particle size, number and weight distribution, particle volume, optical microscopy, sieving, sedimentation, measurement, particle shape, specific surface; methods for determining surface area; permeability, adsorption, and measurement of derived properties of powders like porosity, packing arrangement, densities, bulkiness and flow properties.

Unit II: Viscosity and Rheology:**12hrs**

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 and rotational viscometers.

Unit III: Kinetics and drug stability:**12hrs**

General considerations and concepts, half-life determination, influence of temperature, light, solvent, catalytic species and other factors, accelerated stability study, expiration dating.

Unit IV: Diffusion**12hrs**

Steady state diffusion - diffusion principles in biologic systems –(procedures and apparatus - vapour sorption and transmission –dissolution drug release).

Unit V: Dissolution:**12 hrs**

Dissolution rate and factors affecting rate of dissolution, Noyes Whitney equation.

Total**60 hrs****Course Outcomes**

At the end of the course, the student will be able to

- CO1:** Analyze particle size and distribution of powder by different methods
- CO2:** Apply Newtonian and Non-Newtonian systems for course dispersions.
- CO3:** Determine half-life and Test for stability of Pharmaceutical dosage forms
- CO4:** Importance of diffusion in biologic systems
- CO5:** Explain dissolution rate and factors affecting rate of dissolution

Practicals**0- 0- 3- 2**

1. Determination of particle size, particle size distribution and Surface area using Sieve method.

2. Particle size distribution determination using microscope.
3. Size analysis of calcium carbonate by sedimentation using Andersen pipette.
4. Determination of Bulk density and Void porosity.
5. Determination of Angle of repose of powdered drugs.
6. Determination of effect of Glidants or Lubricants on Angle of repose.
7. Study of rheological properties of various types of systems using different viscometers.
8. Determination of half-life, rate constant and order of reaction.
9. Study of rheological properties of various types of systems using different viscometers.
10. Determination of shelf life of Aspirin solution in 0.1N Hcl using Accelerated stability study.
11. Determination of Compressibility Index
12. Study of Complex formation by PH titration method.

Course Outcomes

At the end of the course, the student will be able to

- CO1:** Find particle size and surface area using sieve method
- CO2:** Determine particle size, distribution using sieving method and microscopic method
- CO3:** Determine rheological properties of various types of systems using different viscometers
- CO4:** Rate the reaction rate constant for first order and second order reactions
- CO5:** Determine compressibility index

Textbooks

1. Experimental pharmaceutical technology, Eugene L. Parrott, Witold Saski.3rd edition publisher Burgess, 1971
2. A Guide to Pharmaceutical Particulate Science, Timothy M. Crowder, Anthony M. Hickey, Margaret D. Louey, Norman Orr. Printed in the United States of America- 2003

Reference Books

1. Martin's Physical Pharmacy and Pharmaceutical Sciences, Alfred N. Martin, Patrick J. Sinko 5th ed publisher: Lippincott Williams & Wilkins, 2011.
2. Textbook of Physical Pharmaceutics, author C. V. S. Subrahmanyam. 2nd ed, Publisher: Vallabh Prakashan, India.
3. Physical Pharmaceutics, Manavalan R Ramasamy C, 2nd ed. Published by Vignesh Publisher.
4. Pharmaceutical Dosage Forms Tablets, Herbert Liberman, Leon Lachman 2nd ed Published by Agarciah1 on Nov 19, 2010.
5. Cooper and Gunn's Tutorial Pharmacy, S.J. Carter. Published by CBS Publishers & Distributors Pvt. Ltd (2005).

15CBPH 22 Pharmaceutical Chemistry-I (Inorganic Chemistry)

Course Objective: An outline of methods of preparation, uses, sources of impurities, test 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

Theory

3-0-0-3

Unit I: Acid, Bases and Gastrointestinal agents

12 hrs

Brief description on Buffers, water, Acid, Bases. Arrhenius Theory of acid and bases. Lowry and bronsted theory, Lewis Acid Base pair, Conjugate Acid Base Pair, ideal characteristics of buffer and antacid, Systemic and Non-Systemic antacids, Acidifying agents, Antacids, protectives and Adsorbents, Cathartics. Types of cathartics, Saline Cathartic, Bulk purgative, Irritant Purgative and stimulant purgatives.

Unit II: Electrolytes and Trace Elements

12 hrs

A study on physiological ions, Major intra and extracellular electrolytes. Their acid base balance, Electrolytes used in replacement therapy, Combination therapy Transition elements and their compounds of pharmaceutical importance: Iron and haematinics, mineral supplements. Cationic and anionic components of inorganic drugs useful for systemic effects.

Unit III: Topical agents and Miscellaneous Agents

12 hrs

A Study about Protectives, Astringents and anti-infectives. A detailed study on 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. Their method of preparation, TFP, Assay etc

Unit IV: Dental products and Medical gases

12 hrs

Dentifrices and anti-carries agents. Ideal characteristic of dentifrices. Abrasives and surfactants used. Oxygen, Anesthetics and respiratory stimulants.

Unit V: Complexing agents and Inorganic radiopharmaceuticals

12 hrs

Complexing and chelating agents used in therapy. Nuclear radio pharmaceuticals, reactions, Nomenclature, methods of obtaining their standards and units of activity, measurement of activity, clinical applications and dosage, hazards and precautions.

Total

60 hrs

Course Outcomes

At the end of the course, the student will be able to

- CO1:** Explain properties of acids and bases. Outline the concepts of acid base theories. Classify, illustrate antacids and gastrointestinal agents.
- CO2:** Physiological and pharmaceutical Importance of Major intra, extracellular electrolytes and trace elements. Study of Iron and haematinics, mineral supplements, Cationic and anionic components of inorganic drugs useful for systemic effects.
- CO3:** Elaborate study of Protectives, Astringents, anti-infectives, Sclerosing agents, expectorants, emetics, poisons and antidotes, sedatives etc. Method of preparation, Assay of Pharmaceutical aids of some inorganic compounds (IP).
- CO4:** Elaborate study of Dentifrices and anti-carries agents. Ideal characteristic of dentifrices. Abrasives and surfactants used. Oxygen, Anesthetics and respiratory stimulants.
- CO5:** Discuss Complexing and chelating agents used in therapy. Elaborate the concepts of Nuclear radio pharmaceuticals clinical applications and dosage, hazards and precautions.

Practicals

0-0-3-2

1. Limit test for chlorides
2. Limit test for sulphates
3. Limit test for iron
4. Limit test for arsenic
5. Preparation and test for purity of boric acid
6. Preparation and test for purity of potash alum
7. Preparation and test for purity of magnesium sulphate
8. Preparation and test for purity of sodium citrate
9. Tests for purity for Bentonite and aluminium hydroxide gel.
10. Tests for purity for kaolin and potash alum.
11. Tests for purity for iodates in potassium iodides
12. Qualitative analysis of mixture of two acid radicals and two basic radicals.

Course Outcomes

At the end of the course, the student will be able to

- CO1:** Test for purity and identify limit tests for iron, arsenic, lead, heavy metals, chloride, sulphate.
- CO2:** Prepare and Estimate test for purity of Boric acid and Potash Alum.
- CO3:** Prepare and Estimate test for purity of Magnesium sulphate and Sodium citrate.
- CO4:** Evaluate the Test for purity for Bentonite and aluminium hydroxide gel.
- CO5:** Evaluate the Test for purity for kaolin and potash alum.

Textbooks

1. Bentley and Driver 's Textbook of pharmaceutical chemistry, L.M.Atherden .,oxford university press, London.
2. Pharmacopiea of India, Ministry of health, Govt of India, New Delhi.

Reference Books

1. Inorganic General, Medical and Pharmaceutical Chemistry. Oldberg,Oscar Vol. 2. 1900. Reprint. London: Forgotten Books, 2013. Print.
2. Vogel's Text Book of Quantitative Chemical Analysis, 6th Edition, 2004.
3. Practical Pharmaceutical Chemistry, Part two, A. H. Beckett & J. B. Stenlake – 4thEdition. Bloomsbery Academic 2001
4. Pharmaceutical chemistry ,G.R.Chatwal, Vol I, Himalaya Pub House 2010..
5. Textbook of inorganic chemistry, Qadry J.S and Qadry S.Z-11th edition ,2011
6. Inorganic pharmaceutical chemistry , P.GunduRao, New edition,Vallabh Publication ,New Delhi,2008.
7. Pharmaceutical inorganic chemistry ,A.V Kasture and S.G.Wadodkar, Nirali Prakashan,2008

Course Objective:

This course is designed to impart a fundamental knowledge on the structure and functions of the human body. It helps in developing a vocabulary of appropriate terminology to effectively communicate information related to anatomy and physiology. It helps in understanding the principle of homeostasis and the use of feedback loops to control physiological systems in the human body. It helps in synthesizing new ideas to make a connection between knowledge of anatomy and physiology and real-world situations, including healthy lifestyle decisions and homeostatic imbalances.

Theory**3-0-0-3****Unit I: Introduction to Basic Terminologies, Cell and Tissue Physiology****12hrs**

- a) Scope of anatomy and physiology and basic terminology used in these subjects.
- b) Structure of cell, its components and their functions.
- c) Elementary tissues of the human body: Epithelial, connective, muscular and nervous tissues, their sub types and characteristics.

Unit II: Osseous system**12hrs**

Structure, composition and functions of skeleton, classification of joints, types of movements at joints, disorders of joints.

Unit III: Skeletal Muscle System**12hrs**

Gross anatomy of Skeletal muscle and physiology of muscle contraction, physiological properties of skeletal muscle and their disorders.

Unit IV: Haemopoietic & Lymphatic system**12hrs**

Composition and functions of blood and its elements, blood groups and their significance, mechanism of coagulation, disorders of blood.

Composition, formulation and circulation of lymph, disorders of lymphatic system. Basic physiology and functions of spleen.

Unit V: Cardiovascular system**12hrs**

Basic anatomy of the heart, physiology of heart, blood vessels and circulation. Basic understanding of cardiac cycle, heart sounds and electrocardiogram. Blood pressure and its regulation. Brief outline of cardiovascular disorders like hypertension, hypotension arteriosclerosis, angina pectoris, myocardial infarction, congestive heart failure and cardiac arrhythmias.

Total**60hrs****Course Outcomes**

At the end of the course, the student will be able to

- CO1:** Develop a vocabulary of appropriate terminology to effectively communicate information related to anatomy and physiology. Identify the various tissues and organs of different systems of human body.
- CO2:** Outline the composition and functions of bone, Classify the joints, types of movements at joints and disorders of joints.
- CO3:** Explain the gross morphology, structure and functions of Skeletal Muscle.
- CO4:** List out the major components of the blood and lymph, Compare and contrast the blood and its components, Lymphatic vessels & lymph nodes structurally and functionally.
- CO5:** Identify the types of circulation and major anatomical areas of the heart. Explain the Electrocardiogram, Blood pressure and cardiovascular disorders.

Practicals

0-0-3-2

1. Various Physiological instruments used in the laboratories.
2. Microscopic study of different tissues.
3. Study of human skeleton.
4. Determination of bleeding time
5. Determination of clotting time
6. Determination of blood grouping
7. Estimation of hemoglobin in blood
8. Estimation of R.B.C. Count
9. Estimation of W.B.C. count
10. Recording of body temperature, pulse rate.
11. Recording of blood pressure at various procedures (sitting, standing).
12. Study of different system using charts and models (Circulatory system, Cardiovascular system, Lymphatic system)

Course Outcomes

At the end of the course, the student will be able to

- CO1:** Utilize the knowledge of Various Physiological instruments used for qualitative and quantitative estimations. Identify the various tissues of different systems of human body.
- CO2:** Determine the hematological tests like bleeding time, clotting time and blood grouping.
- CO3:** Estimate the blood cell counts (RBC, WBC) and haemoglobin content.
- CO4:** Measure the Body temperature, Pulse rate, Blood pressure at sitting and standing posture
- CO5:** Develop coordinated working pattern of different organs of systems like Circulatory system, Cardiovascular system and Lymphatic system.

Textbooks

1. Anatomy and physiology in Health and illness by Anne Waugh & Allison Grant, 12th edition, published by Elsevier,2014.
2. Essentials of Medical Physiology by Sembulingam, 5th edition, published by Jaypee Brothers Medical Pub,2010

References

1. Text book of Medical Physiology by Guyton A.C. Hall J.E., 12th edition, Elsevier Publication, 2010.
2. Human Physiology by C.C. Chatterjee, 11th edition, CBS Publishers, 2015.
3. Principles of Anatomy and physiology by Gerard Tortora & Bryan H. Derrickson, 13th edition, published

by John Wiley & Sons, 2011.

4. Samson Wright's Applied Physiology by Cyril A. Keek, Eric Neil and Norman Joels, 12th edition, published by Oxford University Press, 1971.
5. Textbook of Preventive and Social Medicine by J.E. Park and K. Park. 23rd edition, published by Bhanot, 2015.

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Pharmaceutical Analysis –II

Course Objective

The main objective of course design is to learn about Pharmaceutical Analysis involved in quality control of Pharmaceuticals. To study the theoretical aspect as well as working procedure involved in chromatographic methods like HPLC ,GLC,Column and HPTLC technique.

THEORY

3-0-0-3

Unit I: Titration

12 hrs

(A) Non - Aqueous titrations

Introduction about Non Aqueous Titration, leveling effect,Types of Solvent, Indicators used in non aqueous titration,Application of non aqueous titration

(B) . Complexometric titrations

Introduction about complexometry, Principle involved in complexometry, ligands and types, Types of complexometry, Indicators used in Complexometric titration, P^M indicator and classification. Application of complexometric titration

Unit II. Miscellaneous methods of analysis

10hrs

Principle and working procedure and application following techniques Diazotisation titrations, Kjeldahl method of nitrogen estimation, Karl Fisher titration, Oxygen flask combustion, gasometry.

Unit III: Extraction procedures including separation of drugs from excipients:10 hrs

Definition,Types,Factors affecting extraction procedure, Principle ,Procedure and application involved in infusion,decoction,digestion,maceration and percolation method.

Unit IV Chromatography

16 hrs

Definition, classification of chromatography. Principle involved in chromatography, Types, Instrumentation, working Procedure and application involved in TLC, HPLC, GLC, HPTLC, Paper Chromatography and Column Chromatography

Unit V: Electro metric methods

12 hrs

Introduction of electrometric method. Different types of electrode used in electrometry , different types of current used in polarography. Types of electrometric curve.Principle and working procedure of following electrometric method Potentionmetry, Conductometry , Polarography, Amperometry.

Total

60 hrs

Course Outcomes

At the end of the course, the student will be able to

- CO1:** Classify different types of Non Aqueous and Complexometric titrations. Outline the principles involved in the titrations. Types of Solvents and interpret the indicators involved in the titrations.
- CO2:** Make use of different miscellaneous method of analysis and its working procedure for the following techniques- Diazotisation titrations, Kjeldahl method of nitrogen estimation, Karl Fisher titration, Oxygen flask combustion, gasometry.
- CO3:** Discuss Principle, Procedure and application involved in following extraction procedures- Infusion, decoction, digestion, maceration and percolation method.
- CO4:** Elaborate the theoretical aspect as well as working procedure involved in chromatographic methods like TLC, HPLC, GLC, HPTLC, Paper Chromatography and Column Chromatography.
- CO5:** Discuss Different types of electrode used in electrometry. Elaborate the Principles and working procedure of following electrometric methods-Potentionmetry, Conductometry , Polarography, Amperometry.

Practicals

0-0-2-1

1. Standardization of EDTA
2. Standardization of perchloric acid
3. Assay of calcium gluconate by complexometry
4. Assay of ephedrine hydrochloride as per IP
5. Assay of Phenobarbitone sodium by non aqueous titration
6. Identification of drugs by Thin Layer Chromatography.
7. Identification of drugs by Paper Chromatography Ascending Technique.
8. Identification of drugs by Circular Paper Chromatography Technique.
9. Experiments based on HPLC technique
10. Determination of P^H by using Manual and instrumental method
11. Determination of molarity of alkali by potentiometry.
12. Experiments based on Gas chromatography

Course Outcomes

At the end of the course, the student will be able to

- CO1:** Determine the volume of EDTA and perchloric acid by standardization.
- CO2:** Estimate calcium gluconate by complexometry and Phenobarbitone sodium by non aqueous titration methods.
- CO3:** Identify the drugs/amino acids by Circular Chromatography and Paper Chromatography Ascending Technique.
- CO4:** Determine the pH by using Manual and instrumental method and determine molarity of alkali by potentiometry.
- CO5:** Experiment with HPLC technique and Gas chromatography techniques.

Textbooks

1. A. M. Beckett and J. B. Stenlake ,Practical Pharmaceutical Chemistry, Vol. I & II, 4th edition, CBS Publishers and Distributors, New Delhi,2005.
2. Gurdeep R Chatwal Sham K Anand ,Instrumental Methods of chemical analysis Himalaya publishing house 2014
3. Pharmaceutical Titrimetric Analysis – Theory and Practical, A. A. Napoleon, 1st edition, Kalaimani

publication and Distributors, Tamil Nadu,2006.

Reference Books

1. Principles of instrumental analysis, Douglas A. Skoog, F. James Holler, Timothy A. Nieman. Skoog, Douglas A. 5th ed. Published Philadelphia : Saunders College Pub. ; Orlando, Fla. : Harcourt Brace College Publishers, 1998.
2. Pharmaceutical Analysis – Modern Methods – Part A, Part B, James W. Munson – 2001.
3. Vogel's Text Book of Quantitative Chemical Analysis, 6th Edition, 2004.
4. Gurdeep R Chatwal Sham K Anand ,Instrumental Methods of chemical analysis Himalaya publishing house 2014.

15ABPH21

Mathematics & Statistics

Course Objective:

The course is designed to impart the knowledge in the field of mathematics to science graduate students. The course deals with the advanced mathematics and details of Biostatistics.

Theory

3-0-0-3

Unit I: Differential equations

12 hrs

Revision of integral calculus, definition and formation of differential equations, equations of first order and first degree, variable separable, homogeneous and linear differential equations of order greater than one with constant coefficients, complementary function and particular integral, simultaneous linear differential equations, pharmaceutical applications.

Unit II: Laplace transforms

12 hrs

Definition, transforms of elementary functions, properties of linearity and shifting, inverse laplace transforms, transforms of derivatives, solution of ordinary and simultaneous differential equations.

Unit III: Sampling and Data Collection

12 hrs

Significant digits and rounding of numbers, data collection, random and non-random sampling methods, sample size, data organization

Unit IV: Data Intrepretation & Statistics

12 hrs

Diagrammatic representation of data, bar, pie, 2-D and 3-D diagrams, measures of central tendency, measures of dispersion, standard deviation and standard error of means, coefficient of variation, confidence (fiducial) limits, probability and events,

Unit V: Advanced Statistics

12 hrs

Bayes theorem, probability theorems, probability distributions, elements of binomial and Poisson distribution, normal distribution curve and properties, kurtosis and skewness, correlation and regression analysis, method of least squares, statistical inference, student's and paired T-test, F-test and. elements of ANOVA, applications of statistical concepts in pharmaceutical sciences.

Total

60 hrs

Course Outcomes

At the end of the course, the student will be able to

- CO1: Define the scope and importance of types of data distribution.
- CO2: Classify and summaries the types of graphs, histograms, pie charts, scatter plots and semilogarithmic plots.
- CO3: Apply the concept of central tendency distribution – average, median, mode.
- CO4: Analyze the level of significance (Non parametric data) – sign test, wilcoxon's sign rank test, wilcoxon rank sum test, Kruskal – wall is test (one way ANOVA)
- CO5: Discuss the linear regression and correlation – introduction, person's and spearman's correlation and correlation co-efficient. Introduction to statistical software: SPSS, Epi info, SAS.

Textbooks

1. Text book of Remedial Mathematics by Dr. A Ramakrishna Prasad Cengage Learning, 2012
2. Remedial Mathematics by Shahnaz Bathul, New Arrivals, 2012

Reference Books

1. Pharmaceutical Arithmetic's by Mohd. Ali CBS publishers and distributor, New Delhi.2010
2. Higher Engineering Mathematics by Grewal.43rd edition, Khana Publishers, 2014