**II Year I Semester**

**PHR16211 - PHARMACEUTICAL UNIT OPERATIONS –I (50 Hrs)**

**UNIT-I 10**

**Fluid Flow**: Types of flow, Reynold's number, viscosity, concept of boundary layer, basic equations of fluid flow, valves, flow meters, manometers and measurement of flow and pressure.

*LO:* To understand fluid flow concepts – Reynold’s number, viscosity, flow meters and valves – measurements of flow and pressure.

**UNIT-II 08**

**Material handling systems**:

a. Liquid handling -different types of pumps.

b. Gas handling -various types of fans, blowers and compressors.

c. Solid handling -conveyors

*LO:* To understand material handling systems – liquid, gas and solid handling.

**UNIT-III 08  
Filtration and Centrifugation:** Theory of filtration, filter aids, filter media, industrial filters including filter press, rotary filter, edge filter, etc. Factors affecting filtration, mathematical problems on filtration, optimum-cleaning cycle in batch filters.  
Principles of centrifugation, industrial centrifugal filters, centrifugal filters, and centrifugal sedimeters.

*LO:* To understand theory and equipment of filtration and centrifugation.

**UNIT-IV 08  
Crystallization:** Characteristics of crystals like; purity, size, shape, geometry, habit, forms, size and factors affecting it. Solubility curves and calculation of yields. Material and heat balances around Swenson Walker Crystallizer. Supersaturation theory and its limitations. Nucleation mechanisms, crystal growth. Study of various types of crystallizers, tanks, agitated batch, single vacuum, circulating magma and crystal crystallizers. Caking of crystals and its prevention. Numerical problems on yields.

*LO:* To know the crystallization theory, crystallization equipment and their applications.

**UNIT-V 08**

**Dehumidification and Humidity control**

Basic concepts and definition, wet bulb and adiabatic saturation temperature. Psychrometric chart and measurement of humidity, application of humidity measurement in pharmacy, equipments for dehumidification operations.

*LO:* To know the theory of dehumidification and humidity control, measurement of humidity.

**Refrigeration and Air Conditioning:**

Principles and applications of refrigeration and air conditioning.

*LO:* To understand the principles and applications of refrigeration and air conditioning.

**UNIT-VI 08**

**Materials of Construction:** General study of composition, corrosion, resistance, properties and applications of the materials of construction with special reference to stainless steel and glass.

**Industrial hazards and safety precautions:** Mechanical, Chemical, Electrical, fire and dust hazards. Industrial dermatitis, accident records etc.

*LO:* To understand the materials of construction, their properties and applications. To know the mechanical, chemical, fire and dust hazards and their prevention.

**TEXT BOOKS**

1. Prof. K. Samba Murthy, Pharmaceutical Engineering.
2. Badzer & Banchero, Introduction to Chemical Engineering.
3. C.V.S. Subramanayam, Pharmaceutial Unit Operation, VallabhPrakashan
4. S.J. Carter, Cooper and Gunn’s Tutorial Pharmacy 6ed CBS publisher, Delhi.

**REFERENCES**

1. Perry’s Handbook of Chemical Engineering.
2. Unit Operations by McCabe& Smith.
3. Lippincott Williams and Wilkins: Remington Pharmaceutical Sciences.
4. EA Rawlins, Bently’s Text Book of Pharmaceutics, 8edition, ELBS
5. C.G. Brown, Unit Operations (Indian ed) Asia Publishing House, Bombay
6. Remington’s Pharmaceutical Sciences

**II Year I Semester**

**PHR16212 - PHARMACEUTICAL BIOCHEMISTRY (50Hrs)**

**UNIT – I 06**

**Introduction to Biochemistry**: Outlines of the biochemistry organization of cell organelle,

Molecular constituents of cell membrane, active and passive transport processes across the cell membranes.

**LO:** Introduction, essentials of biochemistry with respect to pharmacy, cell, structure and functions.

**UNIT –II 08**

**Chemistry of carbohydrates, proteins and Lipids**: definitions, classification with examples and structures, properties, reactions and biological significance of carbohydrates, proteins, lipids, nucleic acids, vitamins and minerals.

**LO:** Introduction, basic concepts, structures, properties, significance and uses.

**UNIT – III 10**

**Carbohydrate Metabolism**: Glycolysis, Citric acid cycle (TCA cycle), HMP shunt, Glycogenolysis, Gluconeogenesis, Glycogenesis. Metabolic disorders of carbohydrate metabolism.

**LO:** Introduction to metabolism. Structure, cycles, biological significance and metabolic disorders.

**UNIT – IV 10**

**Lipid Metabolism:** Oxidation of saturated (β - Oxidation), Ketogenesis and Ketolysis; Biosynthesis of Fatty acids, Lipids; Metabolism of cholesterol; Hormonal regulation of Lipid Metabolism. Defective metabolism of Lipids.

**LO:** Introduction to metabolism. Structure, cycles, biological significance and metabolic disorders.

**UNIT – V 08**

**Protein Metabolism:** Protein turnover. Ketabolism of Amino acids (Trans-amination, deamination, de-carboxylation). Urea cycle and it’s metabolic disorders. Outlines of the Metabolism and regulation of Protein synthesis.

**LO:** Introduction to metabolism. Structure, cycles, biological significance and metabolic disorders.

**UNIT – VI 08**

1. **Enzymes:** Classification, mode of action**,** factors affecting enzymes action, Coenzymes, enzyme kinetics.
2. Brief outline of Energy rich compounds, Phosphate metabolism and Electron Transport system, Detoxification mechanisms and their biological significance.

**LO:** Introduction, properties, classes, biochemical role and mode of action.

**TEXT BOOKS**

1. Harper, Biochemistry
2. A.L.Lehninger, Principles of Biochemistry.
3. J.L.Jain, Fundamentals of Biochemistry
4. Satyanarayana, Text Book of Biochemistry
5. Rama Rao, Text Book of Bio Chemistry.
6. Conn, Outlines of biochemistry

**REFERENCES**

1. L.Stryer, Text Book of Bio Chemistry.
2. E.E Conn & P.K. Stumpf, Outlines of Biochemistry by, John Wiley & sons, New York.
3. B.Harrow and A. Mazur, Text Book of Biochemistry, WB Saunders Co., Philadelphia.
4. Boyer Rodney, Modern experimental Bio Chemistry.
5. West, Edward Text Book of Biochemistry.
6. Conn, Outlines of Biochemistry.
7. Plummer, Practical Bio Chemistry.
8. Denniston, Topping & Caret; General, Organic, and Biochemistry, McGraw-Hill

**II Year I Semester**

**PHR16213 - PHYSICAL PHARMACY - II (50 Hrs)**

**UNIT-I 10  
Kinetics:** Rates and orders of the reaction. Influence of temperature and other factors on reaction rates. Decomposition and stabilization of medicinal agents, kinetics in the solid state and accelerated stability analysis (relevant numerical problems).

*LO*: To understand kinetic rates, order of reaction, decomposition pathways and methods of stabilization, stability testing methods, accelerated stability analysis.

**UNIT-II 08  
Interfacial Phenomena:** Liquid interfaces, measurement of surface and interfacial tensions, adsorption at liquid interfaces. Surface active agents and systems of hydrophilic-lipophillic classification. Adsorption at solid interfaces. Electrical properties of interfaces.

*LO*: To understand theory of interfacial phenomenon, absorption, surfactants and theoretical properties of interfaces.

**UNIT-III 08  
Micromeritics:** Particle size and size distribution, methods for determining surface area, methods for determining particle size, pore size, particle shape and surface area, derived properties of powders.

*LO*: To learn micromeritic characteristics and their applications and significance.

**UNIT-IV 08  
Rheology:** Newtonian system, non-Newtonian system, thixotrophy, measurement and applications in formulations. Determination of viscosity and its applications.

*LO*: To understand rheology, types of flow, thixotrophy, its applications and viscosity.

**UNIT –V 08**

**Colloids:** Introduction, types of colloidal systems, preparation and purification of colloids, solubilization, Stability of colloids, optical properties, kinetic properties, electrical properties and Donnan Membrane equilibraium.

*LO*: To know colloids – types – properties – stability considerations.

**UNIT –VI 08**

**Coarse Dispersions:** Suspensions, Emulsions.

Suspensions - interfacial properties of suspended particles settling in suspensions. Formulation of suspensions.

Emulsions - theories of emulsification, physical stability of emulsions, preservation of emulsions, rheological properties of emulsions & suspensions.

*LO:* To know suspension, emulsion theories, types and properties.

**TEXT BOOKS**

1. Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences 5Edition.

2. CVS Subhramanyam, Physical Pharmacy, Vallabhprakashan.

3. Bentley’s text book of Pharmaceutics. E. A. Rawlins

4. B. S. Bahl, Arunbahl and G. D. Tuli. Essentials of Physical Chemistry.

5. Manavalan & Ramasamy, Physical Pharmaceutics, Vignesh Publishers

**REFERENCE**

1. Lippincott Williams and Wilkins, Remington Pharmaceutical Sciences

2. M.E. Aulton, Pharmaceutics – The science of dosage form design, 2edition

3. Deelip Rao Derle & Sai hanuman Sagar Boddu. Essentials of Physical Pharmacy

4. E. Shotton and K. Ridgaway, Physical Pharmaceutics, Oxford University Press, London.

5. Pharmacopoiea (IP, BP, USP and European)

**II Year I Semester**

**PHR16214 - PHARMACEUTICAL MICROBIOLOGY (50 Hrs)**

**UNIT I 10**

**Introduction to Microbiology:** Origin, scope and discovery of spontaneous generations theory, contributions of Antony Von Leuwenhock, Pasteur, Koch and Lister.

**Diversity of Microorganisms:** Prokaryotes versus eukaryotes – Eukaryotic and Prokaryotic cell structure, three domains of life (bacteria, Archea and Eurkaryotics). Pharmaceutical significance of Protozoa, Algae, Fungi, Bacteria and Viruses. Characterization and identification of microorganisms.

*LO*: To understand diversity of microorganisms and their spontaneous generation and use and

harmful nature

**UNIT II 10**

**Nutrition and Growth of Microbes:** Nutritional requirements, Types of Nutrient media and growth conditions and Nutritional types based on energy source.

Isolation, cultivation (aerobic & anaerobic) and preservation of microorganisms, physiology of growth, bacterial growth curve, methods for determing bacterial numbers, mass and cell constitutents. Exponential growth and generation time. Bacterial growth in batch and continuous culture (chemostat and turbidostat) synchronous growth.

**Microorganisms and their Environment: *Effects and microbial adaptations to environmental conditions*** – Temperature, oxygen desiccation, extreme cold ionic effect, electricity, osmotic pressure, radiant energy, hydrostatic pressure, mechanical impact, vibration.

*LO*: To understand that bacterial growth curve consist of rapid growth followed by stabilization and later decline due to exhaustion of nutrients and several parameters affects the above.

**UNIT III 08**

**Control of Microorganisms:** General Concepts, Inhibition of growth and killing, sterilization and disinfection, antisepsis and sanitation, mode of action application & limitation of physical agents (moist and dry heat, radiation and filtration), chemical agents. Various types of disinfectants, factors affecting sterilization and disinfection, evaluation of antimicrobial activity. Chemotherapeutic agents, mode of action and applications, drug resistance. Official methods of sterility testing of pharmaceuticals and biosafety measures.

*LO*: To understand that moist heat, dry heat, radiation, filtration, chemicals can be used for sterilization and disinfection to provide aseptic condition in the filling areas, operation theatres etc

**UNIT IV 10**

**Bacterial Genetics:** Genetic recombination in bacteria, DNA replication, transcription and translation. Gene regulation (lac operon and tryptophan operon).Mutagenesis, chemical and physical mutagens.

*LO*: To understand the concept of bacterial resistance to antibiotics and other conditions.

**UNIT V 04**

**Epidemiology of Diseases:** Study of etiology, diagnosis, source of infection, mode of transmission, immunization methods, prevention and control of the following diseases. Bacillary dysentery, diphtheria, tuberculosis, leprosy, cholera, typhoid, syphilis, gonorrhea, tetanus, food poisoning and infection hepatitis.

*LO*: To understand that microbes are responsible for causing certain diseases.

**UNIT VI 08**

**Microbiological Assays:** Principles and Methods involved in Assay of Antibiotics, Vitamins, Amino acids & Bio-Sensors in Analysis.

*LO*: To understand that antibiotics/Vitamins can be standardized by microbial assays.

**TEXT BOOKS**

1. Pelczar and Reid, Text Book of Microbiology
2. Anantha Narayan and Jayram Panikar, Text Book of Microbiology, Orient Longman, Delhi.
3. N.K. Jain, Pharmaceutical Microbiology
4. Alcamo, Microbiology.

**REFERENCES**

1. Heritage. J, Introductory Microbiology.
2. Nester, Anderson, Roberts, Pearsall, Microbiology, McGraw-Hill.
3. Hugo,W B Pharmaceutical Microbiology.
4. Tortora A. Gerard, Text Book of Microbiology.

**II Year I Semester**

**PHR16215 - HEALTH EDUCATION & PATHOPHYSIOLOGY (50 Hrs)**

**UNIT-I**

**Concepts of health & disease**: 05

Disease causing agents and prevention of disease.

Classification of food requirements, balanced diet, nutritional deficiency disorders, their treatment and prevention, specifications for drinking water.

**First aid:**

Emergency treatment of shock, snake bites, burns, poisoning, fractures and resuscitation methods.

**LO:** To understand that disorder is a physiological change while disease is caused by infecting organisms. Prevention is better than cure concept. First aid for emergency conditions before the patient is moved for medical treatment.

**UNIT – II**

**Demography and family planning:** 05

Demography cycle, family planning and various contraceptive methods. Medical termination of pregnancy.

***LO*:** Problems of over population in providing basic amenities and measures to be adopted for control.

**UNIT-III**

**Basic Principles of cell injury and adaptation:** 04

1. Causes, pathogenesis and morphology of cell injury.
2. Cellular adaptations, atrophy, hypertrophy.
3. Disturbances of growth of cells
4. General biology of tumors
5. Differences between benign and malignant tumors
6. Classification of tumors
7. Etiology and pathogenesis of cancer
8. Patterns of spread of cancer.

**LO:** Different phases of cell growth and disorder to understand normal and tumor cells.

**UNIT-IV**

**Inflammation & Repair:** 08

1. i. Pathogenesis of acute inflammation

ii. Chemical mediators in inflammation

iii. Pathogenesis of chronic inflammation

1. i. Wound healing mechanisms and

ii. Factors affecting wound healing.

1. Pain and its types.

**LO:** To understand that several substances are involved in producing inflammation and to understand different reasons for causing pain.

**UNIT-V  
Diseases of Immunity:** 03

1. Introduction to T and B cells
2. MHC proteins or transplantation antigens.
3. Immune Tolerance
4. **Hypersensitivity** 04
5. Hypersensitivity type I, II, III, IV.
6. Biological significance of hypersensitivity.
7. Allergy due to food, chemicals and drugs
8. **Auto-Immunity:** 05
9. Mechanism of autoimmunity.
10. Classification of autoimmune disease4s in man
11. Transplantation and allograft reactions, mechanism of rejection of allograft.
12. Acquired Immuno Deficiency Syndrome (AIDS)

**LO:** To understand about allergy and body’s resistance against diseases (Natural and adoptive immunity).

**UNIT-VI**

**Pathophysiology of Cardiac disorders:** 03

Shock, stroke, hypertension, Angina, Myocardial infarction, Congestive cardiac failure, Atherosclerosis.

**Pathophysiology of Common Disorders:** 10

Diabetes Mellitus, Abnormalities in Lipoproteinemia, glycogen infiltration and glycogen storage disease. Peptic ulcer, Alcoholic liver diseases, Acute and chronic renal failure, Asthma, Parkinsonism, Schizophrenia, Depression and Mania.

**Infectious diseases:** 03

Infective hepatitis, STD – Syphilis, Gonorrhea, HIV; Pneumonea, Typhoid, UTI, Tuberculosis, Leprosy, Malaria, Dysentery (Bacterial and amoebic).

**LO:** Abnormalities of cardiovascular system, metabolism, respiration, behavior and diseases caused by microorganisms and disorders caused by smoking and alcoholism.

**TEXT BOOKS**

1. Text book of Robbins Pathology basis of Disease – Robins, Cotran, Kumar.

2. Mary V. Buras, Pathophysiology: A self Instructionalprogramme.

3. Mary Lou Mulvihill, Human Diseases: A Systemic approach.

4. General Pathology – Y M Bhende, S G Deodhare, SS Kelkar

5. Essentials of Pathophysiology for Pharmacy. Martin M. Zdanowicz.

Published by Pharma Med Press.

**REFERENCE BOOKS**

1. A.C Guyton, Textbook of medicinal physiology by byW.B.Prism books Pvt. Ltd., Delhi.

2. Joseph Dipiro, Patho Physiology and applied therapeutics.

3. H.P. Rang, M.N.Dale, J.M Riter, Anatomy & Physiology

4. Dr. Jayaveera K.N., Vrushabendra Swamy B.M., Human Anatomy Physiology and Health Education,

S.Chand publ.

**II Year I Semester**

### PHR16216 - PHARMACEUTICAL BIOCHEMISTRY LAB

**Experiments:**

* 1. Identification of carbohydrates
  2. Identification of amino acids.
  3. Identification of lipids.
  4. Estimation of glucose in urine.
  5. Estimation of creatinine in urine.
  6. Estimation of urea in blood.
  7. Estimation of creatinine in blood.
  8. Estimation of Serum protein.
  9. Estimation of bile pigments in serum.
  10. Estimation of alkaline phosphatase in serum
  11. Effect of temperature on the activity of alpha-amylase.
  12. Qualitative analysis of abnormal constituents of urine.
  13. Estimation of glucose by Folin-Wu method.
  14. Estimation of SGOT in Serum.
  15. Estimation of SGPT in Serum.
  16. Determination of sodium, calcium & potassium in serum.

**TEXT BOOK**

1. Ashish S Verma, et.al., Laboratory Manual for Biotechnology, S.Chand.

**II Year I Semester**

**PHR16217 - PHYSICAL PHARMACY - II LAB**

1. Determination of rate constant of hydrolysis of Hydrogen Peroxide.
2. Determination of rate constant of hydrolysis of Ethyl acetate.
3. Effect of temperature on rate of hydrolysis of Ethyl acetate (at least 3 temperatures).
4. Determination of shelf life of drug .
5. Determination of surface tension of a liquid by using stalagnometer.
6. Determination of HLB value of surfactants.
7. Determination of CMC of a surfactant.
8. Construction of Adsorption Isotherm.
9. Determination of bulk density, true density and porosity of a powder.
10. Determination of angle of repose of a powser and studying the effect of lubricants and glidants.
11. Determination of particle size by microscopic method and using Andrea son pipette method.
12. Determination of Viscosity of a liquid by using Ostwald Viscometer.
13. Preparation of purification of hydrophilic and hydrophobic colloids.
14. Determination of sedimentation volume and degree of flocculation of a suspension.
15. Determination of globule size of an emulsion.

**II Year I Semester**

**PHR16218 - PHARMACEUTICAL MICROBIOLOGY LAB**

1. Study of apparatus used in experimental microbiology.
2. Sterilization techniques and their validations.
3. Preparation of various Culture media.
4. Sterilization of Glass ware and culture media.
5. Aseptic transfer of culture into different types of Media.
6. Staining methods - Simple staining, Gram’s staining, Acid fast and negative staining.
7. Motility testing by hanging drop method.
8. Enumeration of bacteria by pour plate/spread plate technique.
9. Enumeration of bacteria by direct microscopic count.
10. Isolation of pure cultures by streak plate, spread plate, pour plate.
11. Evaluation of antiseptics and disinfectants, sterility of pharmaceutical products as per IP requirements.
12. Observation of colony characteristics.
13. Bio chemical reactions:

i) Indole test.

ii) Methyl red test.

iii) Vogesproskauer test.

iv) Starch hydrolysis test.

v) Fermentation of carbohydrates.

14. Morphology of molds, yeasts.

15. Preservation of microorganisms (slant and stab cultures)