TECHNO INDIA UNIVERSITY
WESTBENGAL

B.PHARM SYLLABUS

SEMESTER III

Pharmaceutical Organic Chemistry II –Theory
Credit points-4

Course Outcomes

Upon completion of the course, the student shall be able

CO1	**Summarize** structure, reactions and uses of benzene and its derivatives	K2
CO2	**Illustrate** structure, reactions and uses of phenols, aromatic amines and acids	K2
CO3	**Explain** structure, reactions and uses of fats and oils	K2
CO4	**Demonstrate** synthesis and reactions of polynuclear hydrocarbons	K2
CO5	**Illustrate** the reactions and theories related to cyclo alkanes	K2

Course Content

UNIT I

Benzene and its derivatives

A. Analytical, synthetic and other evidences in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule

B. Reactions of benzene - nitration, sulphonation, halogenations reactivity, Friedelcrafts alkylation- reactivity, limitations, Friedelcrafts acylation.

C. Substituents, effect of substituents on reactivity and orientation of mono substituted benzene compounds towards electrophilic substitution reaction D. Structure and uses of DDT, Saccharin, BHC and Chloramine

UNIT II

Phenols* - Acidity of phenols, effect of substituents on acidity, qualitative tests, Structure and uses of phenol, cresols, resorcinol, naphthols

Aromatic Amines* -Basicity of amines, effect of substituents onbasicity, and synthetic uses of aryl diazonium salts

Aromatic Acids* –Acidity, effect of substituents on acidity and important reactions of benzoic acid.

UNIT III

Fats and Oils

a. Fatty acids – reactions.
b. Hydrolysis, Hydrogenation, Saponification and Rancidity of oils, Drying oils.
c. Analytical constants – Acid value, Saponification value, Ester value, Iodine value, Acetyl value, Reichert Meissl (RM) value – significance and principle involved in their determination.

UNIT IV

Polynuclear hydrocarbons:

a. Synthesis, reactions
b. Structure and medicinal uses of Naphthalene, Phenanthrene, Anthracene, Diphenylmethane, Triphenylmethane and their derivatives

UNIT V

Cyclo alkanes*

Stabilities – Baeyer's strain theory, limitation of Baeyer's strain theory Coulson and Moffitt's modification, Sachse Mohr's theory (Theory of strainless rings), reactions of cyclopropane and cyclobutane only

Pharmaceutical Organic Chemistry II- Practical (TIU-UBP-305P)
Credit points-2

Course Outcomes:

After successful completion of this course, students will be able to:

CO1	**Demonstrate** the systematic qualitative analysis of unknown organic compounds	K2
CO2	**Evaluate** the Functional group and melting point of organic compounds	K4
CO3	**Understand** the suitable solid derivatives from organic compounds	K2
CO4	**Demonstrate** the molecular models	K2
CO5	**Evaluate** unknown organic compounds	K4

Course Content

1. Systematic qualitative analysis of unknown organic compounds like

a. Preliminary test: Color, odour, aliphatic/aromatic compounds, saturation and unsaturation, etc.
b. Detection of elements like Nitrogen, Sulphur and Halogen byLassaigne's test
c. Solubility test
d. Functional group test like Phenols, Amides/ Urea, Carbohydrates, Amines, Carboxylic acids, Aldehydes and Ketones, Alcohols, Esters, Aromatic and Halogenated Hydrocarbons, Nitro compounds and Anilides.

e. Melting point/Boiling point of organic compounds
f. Identification of the unknown compound from the literature using melting point/ boiling point.
g. Preparation of the derivatives and confirmation of the unknown compound bymelting point/ boiling point.
h. Minimum 5 unknown organic compounds to be analysed systematically.

2. Preparation of suitable solid derivatives from organic compounds
3. Construction of molecular models

Physical Pharmaceutics I-Theory (TIU-UBP-302T)
Credit points-4

Course Outcomes
Upon completion of the course, the student shall be able

CO1	**Demonstrate** the factors, importance and laws related to physicochemical properties like solubility of drugs	K2
CO2	**Identify** the different states of matter, their properties and physicochemical properties of drugs	K3
CO3	**Discuss** the different surface and interfacial properties related to pharmaceutical formulations.	K2
CO4	**Discuss** the role of protein binding and complexation in pharmaceutical formulations.	K2
CO5	**Identify** the role of pH and buffers in pharmaceutical formulations.	K3

Course Content

Unit- I
Solubility of drugs: Solubility expressions, mechanisms of solute solvent interactions, ideal solubility parameters, solvation & association, quantitative approach to the factors influencing solubility of drugs, diffusion principles in biological systems. Solubility of gas in liquids, solubility of liquids in liquids, (Binary solutions, ideal solutions)Raoult'slaw, real solutions. Partially miscible liquids, Critical solution temperature and applications.Distribution law, its limitations and applications.

Unit-II
States of Matter and properties of matter: State of matter, changes in the state of matter, latent heats, vapour pressure, sublimation critical point, eutectic mixtures, gases, aerosols – inhalers, relative humidity, liquid complexes, liquid crystals, glassy states, solid- crystalline, amorphous &polymorphism.

Physicochemical properties of drug molecules: Refractive index, optical rotation, dielectric constant, dipole moment, dissociation constant, determinations and applications.

Unit- III

Surface and interfacial phenomenon: Liquid interface, surface & interfacial tensions, surface free energy, measurement of surface & interfacial tensions, spreading coefficient, adsorption at liquid interfaces, surface active agents, HLB Scale, solubilization, detergency, adsorption at solid interface.

Unit- IV

Complexation and protein binding: Introduction, Classification of Complexation, Applications, methods of analysis, protein binding, Complexation and drug action, crystalline structures of complexes and thermodynamic treatment of stability constants.

Unit – V

pH, buffers and Isotonic solutions: Sorensen's pH scale, pH determination (electrometric and calorimetric), applications of buffers, buffer equation, buffer capacity, buffers in pharmaceutical and biological systems, buffered isotonic solutions.

Physical Pharmaceutics I –Practical (TIU-UBP-306P)

Credit points-2

Course Outcomes:

After successful completion of this course, students will be able to:

CO1	**Demonstrate** various formulation described in the pharmaceutical industry	K2
CO2	**Identify** various use of physicochemical properties in evaluation of dosage forms.	K3
CO3	**Evaluate** the effect of various factors related to different physicochemical properties of drugs	K4
CO4	**Explain** suitable graphical plots for presentation of results	K2
CO5	**Evaluate** the process for determination of stability	K4

Course Content

1.Determination the solubility of drug at room temperature

2.Determination of pKa value by Half Neutralization/ Henderson Hasselbalch equation.

3.Determination of Partition co- efficient of benzoic acid in benzene and water

4.Determination of Partition co- efficient of Iodine in CCl4 and water
5.Determination of % composition of NaCl in a solution using phenol-water system by CST method
6.Determination of surface tension of given liquids by drop count and drop weight method
7.Determination of HLB number of a surfactant by saponification method
8.Determination of Freundlich and Langmuir constants using activated char coal
9.Determination of critical micellar concentration of surfactants
10.Determination of stability constant and donor acceptor ratio of PABA-Caffeine complex by solubility method
11.Determination of stability constant and donor acceptor ratio of Cupric-Glycine complex bypH titration method

Pharmaceutical Microbiology –Theory (TIU-UBP-303T)
Credit points-4

Course Outcomes

Upon completion of the course, the student shall be able

CO1	**Summarize** the history of microbiology and **illustrate** various nutritional requirements, physical parameters required for the growth and preservation of bacterial culture, together with different types of microscopy	K2
CO2	**Classify** the different sterilization techniques along with their merits, demerits and efficiency and **demonstrate** the bacterial staining techniques	K2
CO3	**Classify** antiseptics and disinfectants and **illustrate** the structure and morphology of fungi and viruses and the sterility testing methods.	K2
CO4	**Demonstrate** the methods of different microbiological assay and understand design and classification of aseptic area.	K2
CO5	**Identify** sources and types of microbial contaminants, assessment of microbial contamination and spoilage and method for prevention of pharmaceutical contamination.	K3

Course Content

Unit I

Introduction, history of microbiology, its branches, scope and itsimportance.
Introduction to Prokaryotes and Eukaryotes
Study of ultra-structure and morphological classification of bacteria,nutritional requirements, raw materials used for culture media and physicalparameters for growth, growth curve, isolation and preservation methodsfor pure cultures, cultivation of anaerobes, quantitative measurement ofbacterial growth (total & viable count).

Study of different types of phase contrast microscopy, dark field microscopy and electron microscopy.

Unit II

Identification of bacteria using staining techniques (Simple, Gram's &Acidfast staining) and biochemical tests (IMViC).

Study of principle, procedure, merits, demerits and applications of physical,chemical gaseous,radiation and mechanical method of sterilization.

Evaluation of the efficiency of sterilization methods.

Equipments employed in large scale sterilization.

Sterility indicators.

Unit III

Study of morphology, classification, reproduction/replication andcultivation of Fungi and Viruses.

Classification and mode of action of disinfectants

Factors influencing disinfection, antiseptics and their evaluation. Forbacteriostatic and bactericidal actions

Evaluation of bactericidal & Bacteriostatic.

Sterility testing of products (solids, liquids, ophthalmic and other sterileproducts) according to IP, BP and USP.

Unit IV

Designing of aseptic area, laminar flow equipments; study of differentsources of contamination in an aseptic area and methods of prevention,clean area classification.

Principles and methods of different microbiological assay. Methods forstandardization of antibiotics, vitamins and amino acids.

Assessment of a new antibiotic.

Unit V

Types of spoilage, factors affecting the microbial spoilage ofpharmaceutical products, sources and types of microbial contaminants,assessment of microbial contamination and spoilage.

Preservation of pharmaceutical products using antimicrobial agents,evaluation of microbial stability of formulations.

Growth of animal cells in culture, general procedure for cell culture,Primary, established and transformed cell cultures.

Application of cell cultures in pharmaceutical industry and research.

Pharmaceutical Microbiology– Practical (TIU-UBP-307P)
Credit points-2

Course Outcomes:

After successful completion of this course, students will be able to:

CO1	**Demonstrate** the Operation of the various sterilizing equipments.	K2
CO2	**Develop** the subcultures of bacteria and fungus.	K3
CO3	**Describe** the various staining techniques.	K2
CO4	**Describe** the microbiological assay and bacteriological analysis of various pharmaceutical products.	K2
CO5	**Demonstrate** biochemical tests	K2

Course Content

1. Introduction and study of different equipments and processing, e.g., B.O.D. incubator,laminar flow, aseptic hood, autoclave, hot air sterilizer, deep freezer, refrigerator,microscopes used in experimental microbiology.
2. Sterilization of glassware, preparation and sterilization of media.
3. Sub culturing of bacteria and fungus. Nutrient stabs and slants preparations.
4. Staining methods- Simple, Grams staining and acid-fast staining (Demonstration withpractical).
5. Isolation of pure culture of micro-organisms by multiple streak plate technique and other techniques.
6. Microbiological assay of antibiotics by cup plate method and other methods
7. Motility determination by Hanging drop method.
8. Sterility testing of pharmaceuticals.
9. Bacteriological analysis of water
10. Biochemical test.

Pharmaceutical Engineering-Theory (TIU-UBP-304T)
Credit points-4

Course Outcomes

Upon completion of the course, the student shall be able

CO1	**Recognize** the importance, mechanism, applications and laws related to flow of fluids, size reduction and size separation	K2
CO2	**Demonstrate** the factors, mechanism, applications and laws related to heat transfer, evaporation and distillation	K2
CO3	**Interpret** the principle, construction, working, factors and laws governing mixing and drying equipments	K3
CO4	**Summarize** the principle, construction, working, factors and laws governing equipments related to filtration and centrifugation	K2

CO5	**Identify** the various preventive methods used for hazards and corrosion control in Pharmaceutical Industries	K3

Course Content

UNIT-I

Flow of fluids: Types of manometers, Reynolds number and its significance, Bernoulli's theorem and its applications, Energy losses, Orifice meter, Venturimeter, Pitot tube and Rotometer.

Size Reduction: Objectives, Mechanisms & Laws governing size reduction, factors affecting size reduction, principles, construction, working, uses, merits and demerits of Hammer mill, ball mill, fluid energy mill, Edge runner mill & end runner mill.

Size Separation: Objectives, applications & mechanism of size separation, official standards of powders, sieves, size separation Principles, construction, working, uses, merits and demerits of Sieve shaker, cyclone separator, Air separator, Bag filter & elutriation tank.

UNIT-II

Heat Transfer: Objectives, applications & Heat transfer mechanisms. Fourier's law, Heat transfer by conduction, convection & radiation. Heat interchangers & heat exchangers.

Evaporation: Objectives, applications and factors influencing evaporation, differences between evaporation and other heat process. principles, construction, working, uses, merits and demerits of Steam jacketed kettle, horizontal tube evaporator, climbing film evaporator, forced circulation evaporator, multiple effect evaporator& Economy of multiple effect evaporator.

Distillation: Basic Principles and methodology of simple distillation, flash distillation, fractional distillation, distillation under reduced pressure, steam distillation & molecular distillation

UNIT-III

Drying: Objectives, applications & mechanism of drying process, measurements & applications of Equilibrium Moisture content, rate of drying curve. principles, construction, working, uses, merits and demerits of Tray dryer, drum dryer spray dryer, fluidized bed dryer, vacuum dryer, freeze dryer.

Mixing: Objectives, applications & factors affecting mixing, Difference between solid and liquid mixing, mechanism of solid mixing, liquids mixing and semisolids mixing. Principles, Construction, Working, uses, Merits and Demerits of Double cone blender, twin shell blender, ribbon blender, Sigma blade mixer, planetary mixers, Propellers, Turbines, Paddles&Silverson Emulsifier.

UNIT IV

Filtration: Objectives, applications, Theories & Factors influencing filtration, filter aids, filter medias. Principle, Construction, Working, Uses, Merits and demerits of plate & frame filter, filter leaf, rotary drum filter, Meta filter & Cartridge filter, membrane filters and Seitz filter.

Centrifugation: Objectives, principle & applications of Centrifugation, principles, construction, working, uses, merits and demerits of Perforated basket centrifuge, Non-perforated basket centrifuge, semi continuous centrifuge & super centrifuge.

UNIT V

Materials of pharmaceutical plant construction, Corrosion and its prevention: Factors affecting during materials selected for Pharmaceutical plant construction, Theories of corrosion, types of corrosion and there prevention. Ferrous and nonferrous metals, inorganic and organic non metals, basic of material handling systems.

Pharmaceutical Engineering– Practical (TIU-UBP-308P)

Credit points-2

Course Outcomes:

After successful completion of this course, students will be able to:

CO1	**Demonstrate** various unit operations described in the pharmaceutical industry	K2
CO2	**Identify** various laws and related equations governing the various unit operations	K3
CO3	**Evaluate** the effect of various factors on the unit operations.	K4
CO4	**Demonstrate** suitable graphical plots for presentation of results	K2
CO5	**Evaluate** efficiency of equipments	K4

Course Content

1. Determination of radiation constant of brass, iron, unpainted and painted glass.
2. Steam distillation – To calculate the efficiency of steam distillation.
3. To determine the overall heat transfer coefficient by heat exchanger.
4. Construction of drying curves (for calcium carbonate and starch).
5. Determination of moisture content and loss on drying.
6. Determination of humidity of air – i) From wet and dry bulb temperatures –use of Dew point method.
7. Description of Construction working and application of Pharmaceutical Machinery such as rotary tablet machine, fluidized bed coater, fluid energy mill, de humidifier
8. Size analysis by sieving – To evaluate size distribution of tablet granulations –

Construction of various size frequency curves including arithmetic andlogarithmic probability plots.

9. Size reduction: To verify the laws of size reduction using ball mill and determining Kicks, Rittinger's, Bond's coefficients, power requirement and critical speed of Ball Mill.
10. Demonstration of colloid mill, planetary mixer, fluidized bed dryer, freeze dryer and such other major equipment.

11. Factors affecting rate of filtration and evaporation (surface area, concentration and thickness/viscosity)
12. To study the effect of time on the Rate of Crystallization.
13. To calculate the uniformity Index for given sample by using Double Cone Blender.