JAWAHRALAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. PHARMACY II YEAR COURSE STRUTURE AND SYLLABUS

II B. Pharm. I Semester

S.No.	Course Code	CourseName	Hours per week			Credits
			L	T	P	
1.	23BP301T	Pharmaceutical Organic Chemistry II– Theory	3	1	-	4
2.	23BP302T	Physical Pharmaceutics I–Theory	3	1	-	4
3.	23BP303T	Pharmaceutical Microbiology–Theory	3	1	-	4
4.	23BP304T	Pharmaceutical Engineering–Theory	3	-	-	3
5.	23BP305T	Pathophysiology –Theory	3	-	-	3
6.	23BP301P	Pharmaceutical Organic Chemistry II –Practical	-	-	3	1.5
7.	23BP302P	Physical Pharmaceutics I–Practical	-	-	3	1.5
8.	23BP303P	Pharmaceutical Microbiology–Practical	-	-	3	1.5
9.	23BP304P	Pharmaceutical Engineering–Practical	-	-	3	1.5
10.	23BP305	**Skill Oriented course - 1** Preparation of cosmetics (any five)	1	-	2	2
11.	23BP306	**Non-Credit Mandatory Course** Universal Human values and Professional ethics	3	-	-	-
		Total	19	3	14	26

II B. Pharm. II Semester

S.No.	Course Code	Course Name	Hours per week			Credits
			L	T	P	
1.	23BP401T	Medicinal Chemistry I–Theory	3	1	-	4
2.	23BP402T	Physical Pharmaceutics II–Theory	3	1	-	4
3.	23BP403T	Pharmacology I–Theory	3	1	-	4
4.	23BP404T	Pharmacognosy and Phytochemistry I–Theory	3	-	-	3
5.	23BP405T	Pharmaceutical Jurisprudence–Theory	3	-	-	3
6.	23BP401P	Medicinal Chemistry I–Practical	-	-	3	1.5
7.	23BP402P	Physical Pharmaceutics II–Practical	-	-	3	1.5
8.	23BP403P	Pharmacology I–Practical	-	-	3	1.5
9.	23BP404P	Pharmacognosy and Phytochemistry I–Practical	-	-	3	1.5
10.	23BP405	**Skill Oriented course-II** Synthesis of API drugs (minimum five)	1	-	2	2
		Total	16	3	14	26

Mandatory community service internship for 6 to 8 week duration during summer vacation

* For exit Diploma in pharmacy certificate candidate has to secure additional four credits from the following courses:

1. Pharmacotherapeutics 2 credits
2. Hospital and clinical Pharmacy 2 credits

OR

Any course offered by MOOCs / NPTEL/ Swayam/ college/ Govt. agencies equivalent to the above four credits, approved by JNTUA

3. Hospital Training not less than 500 Hrs mandatory

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II Year B.Pharm. I Semester

L	T	P	C
3	1	0	4

(23BP301T) PHARMACEUTICAL ORGANIC CHEMISTRY – II (Theory)

45Hours

Scope: This subject deals with general methods of preparation and reactions of some organic compounds. Reactivity of organic compounds are also studied here. The syllabus emphasizes mechanisms and orientation of reactions. Chemistry of fats and oils are also included in the syllabus.

Objectives: Upon completion of the course the student shall be able to
1. Write the structure, name and the type of isomerism of the organic compound
2. Write the reaction, name the reaction and orientation of reactions
3. Account for reactivity/stability of compounds,
4. Prepare organic compounds

Course Content: General methods of preparation and reactions of compounds superscripted with asterisk (*) to be explained**,** to emphasize on definition, types, classification, principles/mechanisms, applications, examples and differences

UNIT I **10 Hours**

Benzene and its derivatives

A. Synthetic and other evidence in the derivation of structure of benzene, Orbital picture, resonance in benzene, aromatic characters, Huckel's rule
B. Reactions of benzene - nitration, sulphonation, halogenation- reactivity, Friedel-Crafts alkylation-reactivity, limitations, Friedel-Crafts 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 **10 Hour**

Synthesis, reactions and medicinal uses of following compounds/derivatives Pyrazole, Imidazole, Oxazole and Thiazole. Pyridine, Quinoline, Isoquinoline, Acridine and Indole. Basicity of pyridine Synthesis and medicinal uses of Pyrimidine, Purine, azepines and their derivatives

Reactions and synthetic importance:

Metal hydride reduction (NaBH4 and LiAlH4), Clemmensen reduction, Birch reduction, Wolff Kishner reduction. Oppenauer-oxidation and Dakin reaction. Beckmanns rearrangement and Schmidt rearrangement, Claisen-Schmidt condensation

UNIT III **08 Hours**

Polynuclear hydrocarbons:

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

UNIT IV **07 Hours**

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

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UNIT-V **07 Hours**

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.

Recommended Books (Latest Editions)

1. Organic Chemistry by Morrison and Boyd
2. Organic Chemistry by I.L. Finar, Volume-I
3. Textbook of Organic Chemistry by B.S. Bahl & Arun Bahl.
4. Organic Chemistry by P.L.Soni
5. Practical Organic Chemistry by Mann and Saunders.
6. Vogel's text book of Practical Organic Chemistry
7. Advanced Practical organic chemistry by N.K.Vishnoi.
8. Introduction to Organic Laboratory techniques by Pavia, Lampman and Kriz.
9. Heterocyclic Chemistry by T.L. Gilchrist
10. Heterocyclic Chemistry by Raj K. Bansal

Reference Books:

1. Louden M., Organic Chemistry, 5 th edition, Roberts and Company Publishers, 2009.
2. Carey F., Organic Chemistry, 9 th edition, McGraw-Hill Education, 2013.
3. Corey E.J.,Logic of Chemical Synthesis, Wiley-Blackwell; Revised ed., 1995.

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II Year B.Pharm. I Semester

L	T	P	C
3	1	0	4

(23BP302T) PHYSICAL PHARMACEUTICS – I (Theory)

45Hours

Scope: The course deals with the various physical and physicochemical properties, and principles involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives:

Upon the completion of the course student shall be able to

1.Understand various physicochemical properties of drug molecules in the designing the dosage forms

2.Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations

3.Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:

UNIT-I **10 Hours**

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's law, real solutions. Partially miscible liquids, Critical solution temperature and applications. Distribution law, its limitations and applications

UNIT-II **10Hours**

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 **08 Hours**

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 **08Hours**

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 **07 Hours**

P^H, 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.

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Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin
2. Experimental Pharmaceutics by Eugene, Parott.
3. Tutorial Pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical Calculations, Lea &Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, MarcelDekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical Dosage forms. Disperse systems, volume 1, 2,3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C and ManavalanR.
8. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
9. Physical Pharmaceutics by C.V.S. Subramanyam
10. Test book of Physical Phramacy, by Gaurav Jain & Roop K. Khar

Reference Books:

1. A.T. Florence and D. Attwood W: Physiochemical principles of Pharmacy.
2. Shotton and Ridgeway: Physical Pharmaceutics.
3. Remingtons Pharmaceutical Sciences, Mark Publishing Co.
4. H.S. Beans, A.H. Beckett and J.E. Carless: Advances in Pharmaceutical Sciences, Vol. 1 to 4.
5. S.P.Agarwal, Rajesh Khanna: Physical Pharmacy, CBS Publishers, New Delhi.

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II Year B.Pharm. I Semester

L	T	P	C
3	1	0	4

(23BP303T) PHARMACEUTICAL MICROBIOLOGY – (Theory)

45Hours

Scope: Study of all categories of microorganism's especially for the production of alcohol antibiotics, vaccines, vitamins enzymes etc.

Objectives:

Upon completion of the subject student shall be able to;

1. Understand methods of identification, cultivation and preservation of various microorganisms
2. To understand the importance and implementation of sterilization in pharmaceutical processing and industry
3. Learn sterility testing of pharmaceutical products.
4. Carried out microbiological standardization of Pharmaceuticals.
5. Understand the cell culture technology and its applications in pharmaceutical industries.

Course content:

Unit I **10 Hours**

Introduction, history of microbiology, its branches, scope and its importance.

Introduction to Prokaryotes and Eukaryotes

Study of ultra-structure and morphological classification of bacteria, nutritional requirements, raw materials used for culture media and physical parameters for growth, growth curve, isolation and preservation methods for pure cultures, cultivation of anaerobes, quantitative measurement of bacterial growth (total & viable count).

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

Unit II **10 Hours**

Identification of bacteria using staining techniques (simple, Gram's &Acid-fast 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.

Equipment's employed in large scale sterilization. Sterility indicators.

Unit III **10 Hours**

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

Classification and mode of action of disinfectants

Factors influencing disinfection, antiseptics and their evaluation. For bacteriostatic and bactericidal actions

Evaluation of bactericidal & Bacteriostatic.

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

Unit IV **08 Hours**

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

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Principles and methods of different microbiological assay. Methods for standardization of antibiotics, vitamins and amino acids.
Assessment of a new antibiotic.

Unit V **07Hours**

Types of spoilage, factors affecting the microbial spoilage of pharmaceutical 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.

Recommended Books (Latest edition)

1. W.B. Hugo and A.D. Russel: Pharmaceutical Microbiology, Blackwell Scientific publications, Oxford London.
2. Prescott and Dunn., Industrial Microbiology, 4th edition, CBS Publishers & Distributors, Delhi.
3. Pelczar, Chan Kreig, Microbiology, Tata McGraw Hill edn.
4. Malcolm Harris, Balliere Tindall and Cox: Pharmaceutical Microbiology.
5. Rose: Industrial Microbiology.
6. Probisher, Hinsdill et al: Fundamentals of Microbiology, 9th ed. Japan
7. Cooper and Gunn's: Tutorial Pharmacy, CBS Publisher and Distribution.
8. Peppler: Microbial Technology.
9. I.P., B.P., U.S.P.- latest editions.
10. Ananthnarayan : Text Book of Microbiology, Orient-Longman, Chennai
11. Edward: Fundamentals of Microbiology.
12. N.K.Jain: Pharmaceutical Microbiology, Vallabh Prakashan, Delhi
13. Bergeys manual of systematic bacteriology, Williams and Wilkins- A Waverly company

Reference Books:

1. McNeil, Brian, and Linda M. Harvey. Practical fermentation technology. Chichester: Wiley, 2008.
2. Pharmacopoeias: IP,BP,USP,EP

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II Year B.Pharm. I Semester

L	T	P	C
3	0	0	3

(23BP304T) PHARMACEUTICAL ENGINEERING – (Theory)

45Hours

Scope: This course is designed to impart a fundamental knowledge on the art and science of various unit operations used in pharmaceutical industry.

Objectives: Upon completion of the course student shall be able:
1. To know various unit operations used in pharmaceutical industries.
2. To understand the material handling techniques.
3. To perform various processes involved in pharmaceutical manufacturing process.
4. To carry out various test to prevent environmental pollution.
5. To appreciate and comprehend significance of plant lay out design for optimum use of resources.
6. To appreciate the various preventive methods used for corrosion control in pharmaceutical industries.

Course content:

UNIT-I **10 Hours**

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 **10 Hours**

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 **08 Hours**

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 & Silvers on Emulsifier,

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UNIT-IV **08 Hours**

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 **07 Hours**

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 their prevention. Ferrous and nonferrous metals, inorganic and organic nonmetals, basic of material handling systems.

Recommended Books: (Latest Editions)

1. Introduction to chemical engineering – Walter L Badger & Julius Banchero, Latest edition.
2. Solid phase extraction, Principles, techniques and applications by Nigel J.K. Simpson- Latest edition.
3. Unit operation of chemical engineering – Mcabe Smith, Latest edition.
4. Pharmaceutical engineering principles and practices – C.V.S Subrahmanyam et al., Latest edition.
5. Remington practice of pharmacy- Martin, Latest edition.
6. Theory and practice of industrial pharmacy by Lachmann., Latest edition.
7. Physical pharmaceutics- C.V.S Subrahmanyam et al., Latest edition.
8. Cooper and Gunn's Tutorial pharmacy, S.J. Carter, Latest edition.

Reference Books:

1. J.F. Richardson and J.M. Coulron: Chemical Engineering
2. Perry: Handbook of Chemical Engineering
3. Lauer & Heckmann: Chemical Engineering Techniques
4. Peters: Elementary Chemical Engineering

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L	T	P	C
3	0	0	3

(23BP305T) PATHOPHYSIOLOGY – (Theory)

45Hours

Scope: Pathophysiology is the study of causes of diseases and reactions of the body to such disease producing causes. This course is designed to impart a thorough knowledge of the relevant aspects of pathology of various conditions with reference to its pharmacological applications, and understanding of basic pathophysiological mechanisms. Hence it will not only help to study the syllabus of pathology, but also to get baseline knowledge required to practice medicine safely, confidently, rationally and effectively.

Objectives: Upon completion of the subject student shall be able to –
1. Describe the etiology and pathogenesis of the selected disease states;
2. Name the signs and symptoms of the diseases; and
3. Mention the complications of the diseases.

Course content:

Unit I **10Hours**

Basic principles of Cell injury and Adaptation:
Introduction, definitions, Homeostasis, Components and Types of Feedback systems, Causes of cellular injury, Pathogenesis (Cell membrane damage, Mitochondrial damage, Ribosome damage, Nuclear damage), Morphology of cell injury – Adaptive changes (Atrophy, Hypertrophy, hyperplasia, Metaplasia, Dysplasia), Cell swelling, Intra cellular accumulation, Calcification, Enzymeleakage and Cell Death Acidosis & Alkalosis, Electrolyte imbalance

Basic mechanism involved in the process of inflammation and repair:
Introduction, Clinical signs of inflammation, Different types of Inflammation, Mechanism of Inflammation – Alteration in vascular permeability and blood flow, migration of WBC's, Mediators of inflammation, Basic principles of wound healing in the skin, Pathophysiology of Atherosclerosis

Unit II **10Hours**

Cardiovascular System:
Hypertension, congestive heart failure, ischemic heart disease (angina, myocardial infarction, atherosclerosis and arteriosclerosis)
Respiratory system: Asthma, Chronic obstructive airways diseases.
Renal system: Acute and chronic renal failure

Unit III **10Hours**

Hematological Diseases: Iron deficiency, megaloblastic anemia (Vit B12 and folic acid), sickle cell anemia, thalassemia, hereditary acquired anemia, hemophilia
Endocrine system: Diabetes, thyroid diseases, disorders of sex hormones
Nervous system: Epilepsy, Parkinson's disease, stroke,
Psychiatric disorders: Depression, Schizophrenia and Alzheimer's disease.
Gastrointestinal system: Peptic Ulcer

Unit IV **8 Hours**

Inflammatory bowel diseases, jaundice, hepatitis (A,B,C,D,E,F) alcoholic liver disease.
Disease of bones and joints: Rheumatoid arthritis, osteoporosis and gout
Principles of cancer: classification, etiology and pathogenesis of cancer

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Unit V **7 Hours**

Infectious diseases: Meningitis, Typhoid, Leprosy, Tuberculosis Urinary tract infections
Sexually transmitted diseases: AIDS, Syphilis, Gonorrhea

Recommended Books (Latest Editions)

1. Vinay Kumar, Abul K. Abas, Jon C. Aster; Robbins &Cotran Pathologic Basis of Disease; South Asia edition; India; Elsevier; 2014.
2. Harsh Mohan; Text book of Pathology; 6th edition; India; Jaypee Publications; 2010.
3. Laurence B, Bruce C, Bjorn K. ; Goodman Gilman's The Pharmacological Basis of Therapeutics; 12th edition; New York; McGraw-Hill; 2011.
4. Best, Charles Herbert 1899-1978; Taylor, Norman Burke 1885-1972; West, John B (John Burnard); Best and Taylor's Physiological basis of medical practice; 12th ed; united states;
5. William and Wilkins, Baltimore;1991 [1990 printing].
6. Nicki R. Colledge, Brian R. Walker, Stuart H. Ralston;Davidson's Principles and Practice of Medicine; 21st edition; London; ELBS/Churchill Livingstone; 2010.
7. Guyton A, John .E Hall; Textbook of Medical Physiology; 12th edition; WB Saunders Company; 2010.
8. Joseph DiPiro, Robert L. Talbert, Gary Yee, Barbara Wells, L. Michael Posey; Pharmacotherapy: A Pathophysiological Approach; 9th edition; London; McGraw-Hill Medical; 2014.
9. V. Kumar, R. S. Cotran and S. L. Robbins; Basic Pathology; 6th edition; Philadelphia; WB Saunders Company; 1997.
10. Roger Walker, Clive Edwards; Clinical Pharmacy and Therapeutics; 3rd edition; London; Churchill Livingstone publication; 2003.

Recommended Journals

1. The Journal of Pathology. ISSN: 1096-9896 (Online)
2. The American Journal of Pathology. ISSN: 0002-9440
3. Pathology. 1465-3931 (Online)
4. International Journal of Physiology, Pathophysiology and Pharmacology. ISSN: 1944-8171 (Online)
5. Indian Journal of Pathology and Microbiology. ISSN-0377-4929.

Reference Books:

1. Kulkarni, Shrinivas Krishnarao. Hand book of experimental pharmacology. 3rd edition, Vallabh prakashan, 1999.
2. R.K.Goyal, Practicals in Pharmacology, 6th,edition, B.S.ShahPrakashan, Ahmedabad, 2006-2007
3. U.K.Seth, N.K.Dadkar, Usha G.Kamat, Selected Topics in Experimental Pharmacology, 1st edition, Kothari Book Depot Mumbai, 1972
4. Ghosh M.N, Fundamentals of Experimental Pharmacology, 3rd edition, Hilton and Co, Kolkata, 2005

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L	T	P	C
0	0	3	1.5

(23BP301P) PHARMACEUTICAL ORGANIC CHEISTRY – II (Practical)

3 Hours/week

I Experiments involving laboratory techniques

1. Recrystallization
2. Steam distillation

II Determination of following oil values (including standardization of reagents)

1. Acid value
2. Saponification value
3. Iodine value

III Preparation of compounds

1. Benzanilide/ Phenylbenzoate/ Acetanilide from Aniline/Phenol
2. /Aniline by acylation reaction.
3. 2,4,6-Tribromo aniline/Para bromo acetanilide from Aniline/
4. Acetanilide by halogenation (Bromination) reaction.
5. 5-Nitro salicylic acid/Meta di nitro benzene from Salicylic acid / Nitro benzene by nitration reaction.
6. Benzoic acid from Benzyl chloride by oxidation reaction.
7. Benzoic acid/ Salicylic acid from alkyl benzoate/ alkyl salicylate by hydrolysis reaction.
8. 1-Phenyl azo-2-napthol from Aniline by diazotization and coupling reactions.
9. Benzil from Benzoin by oxidation reaction.
10. Dibenzyl acetone from Benzaldehyde by Claison Schmidt reaction
11. Cinnammic acid from Benzaldehyde by Perkin reaction
12. P-Iodo benzoic acid from P-amino benzoic acid

Reference books

1. Practical Organic Chemistry by Mann and Saunders.
2. Vogel's text book of Practical Organic Chemistry
3. Advanced Practical organic chemistry by N.K.Vishnoi.

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L	T	P	C
0	0	3	1.5

(23BP302P) PHYSICAL PHARMACEUTICS – I (Practical)

3 Hours/week

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 by pH titration method

Reference Books

1. Laboratory Manual of Physical Pharmaceutics, C.V.S. Subramanyam, J. Thimma settee
2. Experimental Pharmaceutics by Eugene, Parott.

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L	T	P	C
0	0	3	1.5

(23BP303P) PHARMACEUTICAL MICROBIOLOGY – (Practical)

3 Hours/week

1. Introduction and study of different equipment's 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, Gram's staining and acid-fast staining (Demonstration with practical).
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.

Reference Books

1. McNeil, Brian, and Linda M. Harvey. Practical fermentation technology. Chichester: Wiley, 2008.
2. Pharmacopoeias: IP, BP, USP, EP

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II Year B.Pharm. I Semester

L	T	P	C
0	0	3	1.5

(23BP304P) PHARMACEUTICAL ENGINEERING – (Practical)

3 Hours/week

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 and logarithmic 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.

Reference Books

1. Remington practice of pharmacy- Martin, Latest edition.
2. Theory and practice of industrial pharmacy by Lachmann., Latest edition.

JAWAHRALAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. PHARMACY II YEAR COURSE STRUTURE AND SYLLABUS

II Year B.Pharm. I Semester

L	T	P	C
1	0	2	2

(23BP305) PREPARATION OF COSMETICS (ANY FIVE)

Scope: This subject is designed to impart fundamental knowledge on the preparation of cosmetics. The subject enhace the skills in preparation of cosmetic formulation. The subject also emphasizes regulatory guidelnes on cosmetics.

Upon successful completion of this course, the student should be able to:
CO 1: Understand and Apply of Cosmetic Science Principles
CO 2: Develop skill in Cosmetic Formulation Techniques
CO 3: Adhere to Safety, Regulatory Compliance, and Ethical Considerations in cosmetics.

PREPARATION OF COSMETICS (ANY FIVE)

1. Preparation of Cold Cream
2. Preparation of Calamine lotion
3. Preparation of Tooth powder
4. Preparation of lipsticks
5. Preparation of shampoo
6. Preparation of Sun screen cream
7. Preparation Prefumed Talcum Powder
8. Preparation of Face wash
9. Preparation of Herbal hair oil
10. Preparation of Anti-aging Cream

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II Year B.Pharm. I Semester

L	T	P	C
3	0	0	0

(23BP306) UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS
(Non-Credit Mandatory Course)

Scope: This subject is designed to impart a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

Objectives: Upon completion of the course the student shall be able to
1. To develop understanding of the concepts of Universal Human Values
2. To recognize the relevance of Universal Human Values
3. To develop understanding of value systems that are shared by our culture
4. To critically analyze current issues related to values
5. To develop a sense of personal self in harmony with society and nature through integration of Universal Human Values
6. To explore ways to integrate human values in personal and professional life

Course Content:
This course is intended to provide a much needed orientational input in value education to the young enquiring minds.

UNIT-1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education (9 Hours)
Understanding the Need, Basic Guidelines, Content and Process for Value Education, Self-Exploration–What is it? - its Content and Process; 'Natural Acceptance' and Experiential Validation- as the Mechanism for Self-Exploration, Continuous Happiness and Prosperity- A Look at Basic Human Aspirations, Right Understanding, Relationship and Physical Facilities- the Basic Requirements for Fulfillment of Aspirations of Every Human being with their Correct Priority, Understanding Happiness and Prosperity Correctly- A Critical Appraisal of the Current Scenario, Method to Fulfill the Above Human Aspirations: Understanding and Living in Harmony at Various Levels.

UNIT-II: Understanding Harmony in the Human Being - Harmony in Myself (9 Hours)
Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya

UNIT-III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship (9 Hours)
Understanding Harmony in the Family- the Basic Unit of Human Interaction , Understanding Values in Human-Human Relationship; Meaning of Nyaya and Program for its Fulfillment to Ensure Ubhaytripti; Trust (Vishwas) and Respect (Samman) as the Foundational Values of Relationship, Understanding the Meaning of Vishwas; Difference between Intention and Competence, Understanding the Meaning of Samman, Difference between Respect and Differentiation; the Other

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Salient Values in Relationship, Understanding the Harmony in the Society (Society Being an Extension of Family): Samadhan, Samridhi, Abhay, Sah-Astitva as Comprehensive Human Goals, Visualizing a Universal Harmonious Order in Society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from Family to World Family!

UNIT-IV: Understanding Harmony in the Nature and Existence - Whole Existence as Coexistence (9 Hours)
Understanding the Harmony in the Nature, Interconnectedness and Mutual Fulfilment Among the Four Orders of Nature- Recyclability and Self-Regulation in Nature, Understanding Existence as Coexistence (Sah-Astitva) of Mutually Interacting Units in All-Pervasive Space, Holistic Perception of Harmony at All Levels of Existence.

UNIT-V: Implications of the above Holistic Understanding of Harmony on Professional Ethics (9 Hours)
Natural Acceptance of Human Values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to Utilize the Professional Competence for Augmenting Universal Human Order, b) Ability to Identify the Scope and Characteristics of People-Friendly and Eco-Friendly Production Systems, Technologies and Management Models, Case Studies of Typical Holistic Technologies, Management Models and Production Systems, Strategy for Transition from the Present State to Universal Human Order: a) At the level of Individual: as Socially and Ecologically Responsible Engineers, Technologists and Managers, b) At the Level of Society: as Mutually Enriching Institutions and Organisations.

Recommended Books (Latest Editions)

1. Dr R. R. Gaur, Sh. Rajul Asthana, Sh G.P. Bagaria, A textbook of Human Values and Professional Ethics, Excel books, New Delhi.
2. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excelbooks, New Delhi, 2010, ISBN 978-8-174-46781-2.
3. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010.
4. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted2008.
5. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.

Reference Books:

1. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991.
2. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA.
3. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to
Growth, Club of Rome's Report, Universe Books.
4. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.

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B. PHARMACY II YEAR COURSE STRUTURE AND SYLLABUS

II Year B.Pharm. II Semester

L	T	P	C
3	1	0	4

(23BP401T) MEDICINAL CHEMISTRY – I (Theory)

60 Hours

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The subject emphasizes on structure activity relationships of drugs, importance of physicochemical properties and metabolism of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under each class.

Objectives: Upon completion of the course the student shall be able to

1. Understand the chemistry of drugs with respect to their pharmacological activity
2. Understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. Know the Structural Activity Relationship (SAR) of different class of drugs
4. Write the chemical synthesis of some drugs

Course Content:

Study of the development of the following classes of drugs, Classification, mechanism of action, uses of drugs mentioned in the course, Structure activity relationship of selective class of drugs as specified in the course and synthesis of drugs superscripted (*)

UNIT- I **10 Hours**

Introduction to Medicinal Chemistry

History and development of medicinal chemistry Physicochemical properties in relation to biological action

Ionization, Solubility, Partition Coefficient, Hydrogen bonding, Protein binding, Chelation, Bioisosterism, Optical and Geometrical isomerism.

Drug metabolism

Drug metabolism principles- Phase I and Phase II.

Factors affecting drug metabolism including stereo chemical aspects.

UNIT- II **10 Hours**

Drugs acting on Autonomic Nervous System Adrenergic Neurotransmitters:

Biosynthesis and catabolism of catecholamine.

Adrenergic receptors (Alpha & Beta) and their distribution.

Sympathomimetic agents: SAR of Sympathomimetic agents

Direct acting: Nor-epinephrine, Epinephrine, Phenylephrine*, Dopamine,

Methyldopa, Clonidine, Dobutamine, Isoproterenol, Terbutaline, Salbutamol*, Bitolterol, Naphazoline, Oxymetazoline and Xylometazoline.

Indirectactingagents: Hydroxy amphetamine,Pseudoephedrine, Propylhexedrine.

Agents with mixed mechanism: Ephedrine, Metaraminol.

Adrenergic Antagonists:Alpha adrenergic blockers: Tolazoline*, Phentolamine, Phenoxybenzamine, Prazosin, Dihydroergotamine, Methysergide.

Beta adrenergic blockers: SAR of beta blockers, Propranolol*, Metibranolol, Atenolol, Betazolol, Bisoprolol, Esmolol, Metoprolol, Labetolol, Carvedilol.

UNIT-III **10 Hours**

Cholinergic neurotransmitters.

Biosynthesis and catabolism of acetylcholine.

Cholinergic receptors (Muscarinic & Nicotinic) and their distribution.

Parasympathomimetic agents: SAR of Parasympathomimetic agents

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Direct acting agents: Acetylcholine, Carbachol*, Bethanechol, Methacholine, Pilocarpine.
Indirect acting/ Cholinesterase inhibitors (Reversible & Irreversible): Physostigmine, Neostigmine*, Pyridostigmine, Edrophonium chloride, Tacrine hydrochloride, Ambenonium chloride, Isofluorphate, Echothiophate iodide, Parathione, Malathion.
Cholinesterase reactivator: Pralidoxime chloride.
Cholinergic Blocking agents: SAR of cholinolytic agents
Solanaceous alkaloids and analogues: Atropine sulphate, Hyoscyamine sulphate, Scopolamine hydrobromide, Homatropine hydrobromide, Ipratropium bromide*.
Synthetic cholinergic blocking agents: Tropicamide, Cyclopentolate hydrochloride, Clidinium bromide, Dicyclomine hydrochloride*, Glycopyrrolate, Methantheline bromide, Propantheline bromide, Benztropine mesylate, Orphenadrine citrate, Biperidine hydrochloride, Procyclidine hydrochloride*, Tridihexethyl chloride, Isopropamide iodide, Ethopropazine hydrochloride.

UNIT- IV **10 Hours**

Drugs acting on Central Nervous System

A.Sedatives and Hypnotics:

Benzodiazepines: SAR of Benzodiazepines, Chlordiazepoxide, Diazepam*, Oxazepam, Chlorazepate, Lorazepam, Alprazolam, Zolpidem

Barbiturtes: SAR of barbiturates, Barbital*, Phenobarbital, Mephobarbital, Amobarbital, Butabarbital, Pentobarbital, Secobarbital

Miscelleneous:

Amides &imides: Glutethmide.

Alcohol & their carbamate derivatives: Meprobomate, Ethchlorvynol. Aldehyde & their derivatives: Triclofos sodium, Paraldehyde.

B.Antipsychotics

Phenothiazeines: SAR of Phenothiazeines - Promazine hydrochloride, Chlorpromazine hydrochloride*, Triflupromazine, Thioridazine hydrochloride, Piperacetazine hydrochloride, Prochlorperazine maleate, Trifluoperazine hydrochloride.

Ring Analogues of Phenothiazeines: Chlorprothixene, Thiothixene, Loxapine succinate, Clozapine.

Fluro buterophenones: Haloperidol, Droperidol, Risperidone.

Beta amino ketones: Molindone hydrochloride.

Benzamides: Sulpieride.

C.Anticonvulsants: SAR of Anticonvulsants, mechanism of anticonvulsant action

Barbiturates: Phenobarbitone, Methabarbital.

Hydantoins: Phenytoin*, Mephenytoin,

Ethotoin Oxazolidine diones: Trimethadione, Paramethadione

Succinimides: Phensuximide, Methsuximide, Ethosuximide*

Urea and monoacylureas: Phenacemide, Carbamazepine* Benzodiazepines: Clonazepam

Miscellaneous: Primidone, Valproic acid, Gabapentin, Felbamate

UNIT – V **10 Hours**

Drugs acting on Central Nervous System

General anesthetics

Inhalation anesthetics: Halothane*, Methoxyflurane, Enflurane, Sevoflurane, Isoflurane, Desflurane.

Ultra short acting barbitutrates: Methohexital sodium*, Thiamylal sodium, Thiopental sodium.

Dissociative anesthetics: Ketamine hydrochloride*.

Narcotic and non-narcotic analgesics

Morphine and related drugs: SAR of Morphine analogues, Morphine sulphate, Codeine, Meperidine hydrochloride, Anilerdine hydrochloride, Diphenoxylate hydrochloride, Loperamide hydrochloride, Fentanyl citrate*, Methadone hydrochloride*, Propoxyphene hydrochloride, Pentazocine, Levorphanol tartarate.

Narcotic antagonists: Nalorphine hydrochloride, Levallorphantartarate, Naloxone hydrochloride.

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Anti-inflammatory agents: Sodium salicylate, Aspirin, Mefenamic acid*, Meclofenamate, Indomethacin, Sulindac, Tolmetin, Zomepriac, Diclofenac, Ketorolac, Ibuprofen*, Naproxen, Piroxicam, Phenacetin, Acetaminophen, Antipyrine, Phenylbutazone.

Recommended Books (Latest Editions)

1. Wilson and Giswold's Organic medicinal and Pharmaceutical Chemistry.
2. Foye's Principles of Medicinal Chemistry.
3. Burger's Medicinal Chemistry, Vol I to IV.
4. Introduction to principles of drug design- Smith and Williams.
5. Remington's Pharmaceutical Sciences.
6. Martindale's extra pharmacopoeia.
7. Organic Chemistry by I.L. Finar, Vol. II.
8. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
9. Indian Pharmacopoeia.
10. Text book of practical organic chemistry- A.I.Vogel.

Reference Books:

1. R.T. Morrison and R.N. Boyd: Organic Chemistry, Allyn and Bacon Inc., Boston (USA).
2. I.L. Finar: Organic Chemistry, Vol. I & II, ELBS and Longman Group Ltd., London.
3. L.M. Atherden: Bentley and Driver's-Textbookof Pharmaceutical Chemistry, Oxford University Press, Delhi

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II Year B.Pharm. II Semester

L	T	P	C
3	1	0	4

(23BP402T) PHYSICAL PHARMACECUTICS – II (Theory)

60 Hours

Scope: The course deals with the various physical and physicochemical properties, and principals involved in dosage forms/formulations. Theory and practical components of the subject help the student to get a better insight into various areas of formulation research and development, and stability studies of pharmaceutical dosage forms.

Objectives: Upon the completion of the course student shall be able to

1. Understand various physicochemical properties of drug molecules in the designing the dosage forms
2. Know the principles of chemical kinetics & to use them for stability testing nad determination of expiry date of formulations
3. Demonstrate use of physicochemical properties in the formulation development and evaluation of dosage forms.

Course Content:

UNIT-I 10 Hours

Colloidal dispersions: Classification of dispersed systems & their general characteristics, size & shapes of colloidal particles, classification of colloids & comparative account of their general properties. Optical, kinetic & electrical properties. Effect of electrolytes, coacervation, peptization& protective action.

UNIT-II 10 Hours

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 Sphere, rotational viscometers

Deformation of solids: Plastic and elastic deformation, Heckel equation, Stress, Strain, Elastic Modulus

UNIT-III 10 Hours

Coarse dispersion: Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspensions. Emulsions and 0theories of emulsification, microemulsion and multiple emulsions; Stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formulation by HLB method.

UNIT-IV 10Hours

Micromeritics: Particle size and distribution, mean particle size, number and weight distribution, particle number, methods for determining particle size by different methods, counting and separation method, particle shape, specific surface, methods for determining surface area, permeability, adsorption, derived properties of powders, porosity, packing arrangement, densities, bulkiness & flow properties.

UNIT-V 10 Hours

Drug stability: Reaction kinetics: zero, pseudo-zero, first & second order, units of basic rate constants, determination of reaction order. Physical and chemical factors influencing the chemical degradation of pharmaceutical product: temperature, solvent, ionic strength, dielectric constant, specific & general acid base catalysis, Simple numerical problems. Stabilization of medicinal agents against common

reactions like hydrolysis & oxidation. Accelerated stability testing in expiration dating of pharmaceutical dosage forms. Photolytic degradation and its prevention

Recommended Books: (Latest Editions)

1. Physical Pharmacy by Alfred Martin, Sixth edition
2. Experimental pharmaceutics by Eugene, Parott.
3. Tutorial pharmacy by Cooper and Gunn.
4. Stocklosam J. Pharmaceutical calculations, Lea & Febiger, Philadelphia.
5. Liberman H.A, Lachman C., Pharmaceutical Dosage forms, Tablets, Volume-1 to 3, Marcel Dekkar Inc.
6. Liberman H.A, Lachman C, Pharmaceutical dosage forms. Disperse systems, volume 1, 2, 3. Marcel Dekkar Inc.
7. Physical Pharmaceutics by Ramasamy C, and Manavalan R.

Reference Books:

1. A.T. Florence and D. Attwood W: Physiochemical principles of Pharmacy.
2. Shotton and Ridgeway: Physical Pharmaceutics.
3. Remingtons Pharmaceutical Sciences, Mark Publishing Co.
4. H.S. Beans, A.H. Beckett and J.E. Carless: Advances in Pharmaceutical Sciences, Vol. 1 to 4.
5. S.P.Agarwal, Rajesh Khanna: Physical Pharmacy, CBS Publishers, New Delhi.

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II Year B.Pharm. II Semester

L	T	P	C
3	1	0	4

(23BP403T) PHARMACOLOGY – I (Theory)

60 Hours

Scope: The main purpose of the subject is to understand what drugs do to the living organisms and how their effects can be applied to therapeutics. The subject covers the information about the drugs like, mechanism of action, physiological and biochemical effects (pharmacodynamics) as well as absorption, distribution, metabolism and excretion (pharmacokinetics) along with the adverse effects, clinical uses, interactions, doses, contraindications and routes of administration of different classes of drugs.

Objectives: Upon completion of this course the student should be able to
1. Understand the pharmacological actions of different categories of drugs
2. Explain the mechanism of drug action at organ system/sub cellular/ macromolecular levels.
3. Apply the basic pharmacological knowledge in the prevention and treatment of various diseases.
4. Observe the effect of drugs on animals by simulated experiments
5. Appreciate correlation of pharmacology with other bio medical sciences

Course Content:

UNIT-I **08 hours**

1.General Pharmacology

a. Introduction to Pharmacology- Definition, historical landmarks and scope of pharmacology, nature and source of drugs, essential drugs concept and routes of drug administration, Agonists, antagonists (competitive and non-competitive), spare receptors, addiction, tolerance, dependence, tachyphylaxis, idiosyncrasy, allergy.

b. Pharmacokinetics- Membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition, kinetics of elimination

UNIT-II **12 Hours**

c. Pharmacodynamics- Principles and mechanisms of drug action. Receptor theories and classification of receptors, regulation of receptors. drug receptors interactions signal transduction mechanisms, G-protein–coupled receptors, ion channel receptor, transmembrane enzyme linked receptors, transmembrane JAK-STAT binding receptor and receptors that regulate transcription factors, dose response relationship, therapeutic index, combined effects of drugs and factors modifying drug action.

d. Adverse drug reactions.

e. Drug interactions (pharmacokinetic and pharmacodynamic)

f. Drug discovery and clinical evaluation of new drugs -Drug discovery phase, preclinical evaluation phase, clinical trial phase, phases of clinical trials and pharmacovigilance.

UNIT-III **10 Hours**

2. Pharmacology of drugs acting on peripheral nervous system

a. Organization and function of ANS.
b. Neurohumoral transmission, co-transmission and classification of neurotransmitters.
c. Para sympathomimetics, Parasympatholytic, Sympathomimetics, sympatholytic.
d. Neuromuscular blocking agents and skeletal muscle relaxants (peripheral).
e. Local anesthetic agents.
f. Drugs used in myasthenia gravis and glaucoma

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UNIT-IV **10 Hours**

3. Pharmacology of drugs acting on central nervous system

a. Neurohumoral transmission in the C.N.S.special emphasis on importance of various neurotransmitters like with GABA, Glutamate, Glycine, serotonin, dopamine.
b. General anesthetics and pre-anesthetics.
c. Sedatives, hypnotics and centrally acting muscle relaxants.
d. Anti-epileptics
e. Alcohols and disulfiram

UNIT-V **10 Hours**

3. Pharmacology of drugs acting on central nervous system
f. Psychopharmacological agents: Antipsychotics, antidepressants, anti-anxiety agents, anti-manics and hallucinogens.
g. Drugs used in Parkinsons disease and Alzheimer's disease.
h. CNS stimulants and nootropics.
i. Opioid analgesics and antagonists
j. Drug addiction, drug abuse, tolerance and dependence.

Recommended Books (Latest Editions)

1. Rang H. P., Dale M. M., Ritter J. M., Flower R. J., Rang and Dale's Pharmacology,.Churchil Livingstone Elsevier
2. Katzung B. G., Masters S. B., Trevor A. J., Basic and clinical pharmacology, Tata Mc Graw-Hill
3. Goodman and Gilman's, The Pharmacological Basis of Therapeutics
4. Marry Anne K. K., Lloyd Yee Y., Brian K. A., Robbin L.C., Joseph G. B., Wayne A. K., Bradley R.W., Applied Therapeutics, The Clinical use of Drugs, The Point Lippincott Williams & Wilkins
5. Mycek M.J, Gelnet S.B and Perper M.M. Lippincott's Illustrated Reviews- Pharmacology
6. K.D. Tripathi. Essentials of Medical Pharmacology, JAYPEE Brothers Medical Publishers (P) Ltd, New Delhi.
7. Sharma H. L., Sharma K. K., Principles of Pharmacology, Paras medical publisher
8. Modern Pharmacology with clinical Applications, by Charles R. Craig& Robert,
9. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
10. Kulkarni SK. Handbook of experimental pharmacology. Vallabh Prakashan,

Reference Books:

1. Lippincott's Illustrated Reviews, Pharmacology 6th edition, Wolters Kluwer, 2015
2. R.S. Satoskar, S.D. Bhandarkar, Pharmacology and Pharmacotherapeutics 24th Edition, 2015
3. F.S.K. Barar, Essentials of Pharmacotherapeutics 1st edition, S. Chand and Company Ltd, 2004

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II Year B.Pharm. II Semester

L	T	P	C
3	0	0	3

(23BP404T) PHARMACOGNOSY AND PHYTOCHEMISTRY – I (Theory)

45Hours

Scope: The subject involves the fundamentals of Pharmacognosy like scope, classification of crude drugs, their identification and evaluation, phytochemicals present in them and their medicinal properties.

Objectives: Upon completion of the course, the student shall be able
1. To know the techniques in the cultivation and production of crude drugs
2. To know the crude drugs, their uses and chemical nature
3. Know the evaluation techniques for the herbal drugs
4. To carry out the microscopic and morphological evaluation of crude drugs

Course Content:

UNIT-I **10 Hours**

Introduction to Pharmacognosy:

(a) Definition, history, scope and development of Pharmacognosy
(b) Sources of Drugs – Plants, Animals, Marine & Tissue culture
(c) Organized drugs, unorganized drugs (dried latex, dried juices, dried extracts, gums and mucilages, oleoresins and oleo- gum -resins).

Classification of drugs:

Alphabetical, morphological, taxonomical, chemical, pharmacological, chemo and sero taxonomical classification of drugs

Quality control of Drugs of Natural Origin:

Adulteration of drugs of natural origin. Evaluation by organoleptic, microscopic, physical, chemical and biological methods and properties.

Quantitative microscopy of crude drugs including lycopodium spore method, leafconstants, camera lucida and diagrams of microscopic objects to scale with camera lucida.

UNIT-II **10 Hours**

Cultivation, Collection, Processing and storage of drugs of natural origin:

Cultivation and Collection of drugs of natural origin Factors influencing cultivation of medicinal plants. Plant hormones and their applications.

Polyploidy, mutation and hybridization with reference to medicinal plants

Conservation of medicinal plants

UNIT-III **07 Hours**

Plant tissue culture:

Historical development of plant tissue culture, types of cultures, Nutritional requirements, growth and their maintenance.

Applications of plant tissue culture in pharmacognosy. Edible vaccines

UNIT IV **10 Hours**

Pharmacognosy in various systems of medicine:

Role of Pharmacognosy in allopathy and traditional systems of medicine namely, Ayurveda, Unani, Siddha, Homeopathy and Chinese systems of medicine.

Introduction to secondary metabolites:

Definition, classification, properties and test for identification of Alkaloids, Glycosides, Flavonoids,

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Tannins, Volatile oil and Resins

UNIT V **08 Hours**

Study of biological source, chemical nature and uses of drugs of natural origin containing following drugs

Plant Products:

Fibers - Cotton, Jute, Hemp

Hallucinogens, Teratogens, Natural allergens

Primary metabolites:

General introduction, detailed study with respect to chemistry, sources, preparation, evaluation, preservation, storage, therapeutic used and commercial utility as Pharmaceutical Aids and/or Medicines for the following Primary metabolites:

Carbohydrates: Acacia, Agar, Tragacanth, Honey

Proteins and Enzymes: Gelatin, casein, proteolytic enzymes (Papain, bromelain, serrati peptidase, urokinase, streptokinase, pepsin).

Lipids (Waxes, fats, fixed oils): Castor oil, Chaulmoogra oil, Wool Fat, Bees Wax

Marine Drugs:

Novel medicinal agents from marine sources

Recommended Books: (Latest Editions)

1. W.C. Evans, Trease and Evans Pharmacognosy, 16th edition, W.B. Sounders & Co., London, 2009.
2. Tyler, V.E., Brady, L.R. and Robbers, J.E., Pharmacognosy, 9th Edn., Lea and Febiger, Philadelphia, 1988.
3. Text Book of Pharmacognosy by T.E. Wallis
4. Mohammad Ali. Pharmacognosy and Phytochemistry, CBS Publishers & Distribution, New Delhi.
5. Text book of Pharmacognosy by C.K. Kokate, Purohit, Gokhlae (2007), 37th Edition, Nirali Prakashan, New Delhi.
6. Herbal drug industry by R.D. Choudhary (1996), IstEdn, Eastern Publisher, New Delhi.
7. Essentials of Pharmacognosy, Dr.SH.Ansari, IInd edition, Birla publications, New Delhi, 2007
8. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
9. Anatomy of Crude Drugs by M.A. Iyengar

Reference Books:

1. Dewick, Paul M. Medicinal natural products: a biosynthetic approach. 2nd edition, John Wiley &Sons, 2002
2. Bruneton J, Pharmacognosy & Phytochemistry Medicinal Plants,2nd edition, Lavoisier Publishing Inc. 1999
3. Harborne J.B. Phytochemical Methods- A Guide to modern techniques of Plant analysis, 3rd edition, Springer, 1998
4. Ikan R., Natural Products- A Laboratory Guide, 2nd edition, Academic Press, 1994

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II Year B.Pharm. II Semester

L	T	P	C
3	0	0	3

(23BP405T) PHARMACEUTICAL JURISPRUDENCE – I (Theory)

45Hours

Scope: This course is designed to impart basic knowledge on important legislations related to the profession of pharmacy in India

Objectives: Upon completion of the course, the student shall be able to understand:

1. The Pharmaceutical legislations and their implications in the development and marketing of pharmaceuticals.
2. Various Indian pharmaceutical Acts and Laws
3. The regulatory authorities and agencies governing the manufacture and sale of pharmaceuticals
4. The code of ethics during the pharmaceutical practice

Course Content:

UNIT-I **8 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945:

Objectives, Definitions, Legal definitions of schedules to the Act and Rules

Import of drugs – Classes of drugs and cosmetics prohibited from import, Import under license or permit. Offences and penalties.

Manufacture of drugs – Prohibition of manufacture and sale of certain drugs,

Conditions for grant of license and conditions of license for manufacture of drugs, Manufacture of drugs for test, examination and analysis, manufacture of new drug, loan license and repacking license.

UNIT-II **10 Hours**

Drugs and Cosmetics Act, 1940 and its rules 1945

Detailed study of Schedule G, H, M, N, P, T,U, V, X, Y, Part XII B, Sch F & DMR (OA) Sale of Drugs – Wholesale, Retail sale and Restricted license. Offences and penalties

Labeling &packing of drugs- General labeling requirements and specimen labels for drugs and cosmetics, List of permitted colors. Offences and penalties.

Administration of the Act and Rules – Drugs Technical Advisory Board, Central drugs Laboratory, Drugs Consultative Committee, Government drug analysts, licensing authorities, controlling authorities, Drugs Inspectors

UNIT-III **10 Hours**

•**Pharmacy Act –1948:** Objectives, Definitions, Pharmacy Council of India; its constitution and functions, Education Regulations, State and Joint state pharmacy councils; constitution and functions, Registration of Pharmacists, Offences and Penalties

•**Medicinal and Toilet Preparation Act –1955:** Objectives, Definitions, Licensing, Manufacture In bond and Outside bond, Export of alcoholic preparations, Manufacture of Ayurvedic, Homeopathic, Patent & Proprietary Preparations. Offences and Penalties.

•**Narcotic Drugs and Psychotropic substances Act-1985 and Rules:** Objectives, Definitions, Authorities and Officers, Constitution and Functions of narcotic & Psychotropic Consultative Committee, National Fund for Controlling the Drug Abuse, Prohibition, Control and Regulation, opium poppy cultivation and production of poppy straw, manufacture, sale and export of opium, Offences and Penalties

UNIT-IV **09 Hours**

•**Study of Salient Features of Drugs and Magic Remedies Act and its rules:** Objectives, Definitions, Prohibition of certain advertisements, Classes of Exempted advertisements, Offences and Penalties

JAWAHRALAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. PHARMACY II YEAR COURSE STRUTURE AND SYLLABUS

•**Prevention of Cruelty to animals Act-1960:** Objectives, Definitions, Institutional Animal Ethics Committee, CPCSEA guidelines for Breeding and Stocking of Animals, Performance of Experiments, Transfer and acquisition of animals for experiment, Records, Power to suspend or revoke registration, Offences and Penalties

•**National Pharmaceutical Pricing Authority:** Drugs Price Control Order (DPCO)- 2013. Objectives, Definitions, Sale prices of bulk drugs, Retail price of formulations, Retail price and ceiling price of scheduled formulations, National List of Essential Medicines (NLEM)

UNIT-V **08 Hours**

•**Pharmaceutical Legislations –** A brief review, Introduction, Study of drugs enquiry committee, Health survey and development committee, Hathi committee and Mudaliar committee

•**Code of Pharmaceutical ethics** Definition, Pharmacist in relation to his job, trade, medical profession and his profession, Pharmacist's oath

•Medical Termination of Pregnancy Act

•Right to Information Act

•Introduction to Intellectual Property Rights (IPR)

Recommended books: (Latest Edition)

1. Forensic Pharmacy by B. Suresh
2. Text book of Forensic Pharmacy by B.M. Mithal
3. Hand book of drug law-by M.L. Mehra
4. A text book of Forensic Pharmacy by N.K. Jain
5. Drugs and Cosmetics Act/Rules by Govt. of India publications.
6. Medicinal and Toilet preparations act 1955 by Govt. of India publications.
7. Narcotic drugs and psychotropic substances act by Govt. of India publications
8. Drugs and Magic Remedies act by Govt. of India publication
9. Bare Acts of the said laws published by Government.

Reference Books:

1. N. K. Jain: Pharmaceutical Jurisprudence
2. S. P. Aggarwal and R. Khanna: Pharmaceutical Jurisprudence, Tata Publishers.

JAWAHRALAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. PHARMACY II YEAR COURSE STRUTURE AND SYLLABUS

II Year B.Pharm. II Semester

L	T	P	C
0	0	3	1.5

(23BP401P) MEDICINAL CHEISTRY – I (Practical)

3 Hours/week

I. Preparation of drugs/ intermediates

1. 1,3-pyrazole
2. 1,3-oxazole
3. Benzimidazole
4. Benztriazole
5. 2,3- diphenyl quinoxaline
6. Benzocaine
7. Phenytoin
8. Phenothiazine
9. Barbiturate

II. Assay of drugs

1. Chlorpromazine
2. Phenobarbitone
3. Atropine
4. Ibuprofen
5. Aspirin
6. Furosemide

III. Determination of Partition coefficient for any two drugs

Recommended Books (Latest Editions)

1. The Organic Chemistry of Drug Synthesis by Lednicer, Vol. 1-5.
2. Indian Pharmacopoeia.
3. Text book of practical organic chemistry- A.I.Vogel

JAWAHRALAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. PHARMACY II YEAR COURSE STRUTURE AND SYLLABUS

II Year B.Pharm. II Semester

L	T	P	C
0	0	3	1.5

(23BP402P) PHYSICAL PHARMACEUTICS – II (Practical)

3 Hours/week

1. Determination of particle size, particle size distribution using sieving method
2. Determination of particle size, particle size distribution using microscopic method
3. Determination of bulk density, true density and porosity
4. Determine the angle of repose and influence of lubricant on angle of repose
5. Determination of viscosity of liquid using Ostwald's viscometer
6. Determination sedimentation volume with effect of different suspending agent
7. Determination sedimentation volume with effect of different concentration of single suspending agent
8. Determination of viscosity of semisolid by using Brookfield viscometer
9. Determination of reaction rate constant first order.
10. Determination of reaction rate constant second order
11. Accelerated stability studies

Recommended Books (Latest Editions)

1. Experimental pharmaceutics by Eugene, Parott.
2. Physical Pharmacy by Alfred Martin, Sixth edition

JAWAHRALAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. PHARMACY II YEAR COURSE STRUTURE AND SYLLABUS

II Year B.Pharm. II Semester

L	T	P	C
0	0	3	1.5

(23BP403P) PHARMACOLOGY – I (Practical)

3 Hours/week

1. Introduction to experimental pharmacology.
2. Commonly used instruments in experimental pharmacology.
3. Study of common laboratory animals.
4. Maintenance of laboratory animals as per CPCSEA guidelines.
5. Common laboratory techniques. Blood withdrawal, serum and plasma separation, anesthetics and euthanasia used for animal studies.
6. Study of different routes of drugs administration in mice/rats.
7. Study of effect of hepatic microsomal enzyme inducers on the phenobarbitone sleeping time in mice.
8. Effect of drugs on ciliary motility of frog esophagus
9. Effect of drugs on rabbit eye.
10. Effects of skeletal muscle relaxants using rota-rod apparatus.
11. Effect of drugs on locomotor activity using actophotometer.
12. Anticonvulsant effect of drugs by MES and PTZ method.
13. Study of stereotype and anti-catatonic activity of drugs on rats/mice.
14. Study of anxiolytic activity of drugs using rats/mice.
15. Study of local anesthetics by different methods

Note: All laboratory techniques and animal experiments are demonstrated by simulated experiments by software's and videos

Recommended Books (Latest Editions)

1. Ghosh MN. Fundamentals of Experimental Pharmacology. Hilton & Company, Kolkata.
2. Kulkarni SK. Handbook of experimental pharmacology. VallabhPrakashan

JAWAHRALAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. PHARMACY II YEAR COURSE STRUTURE AND SYLLABUS

II Year B.Pharm. II Semester

L	T	P	C
0	0	3	1.5

(23BP404P) PHARMACOGNOSY AND PHYTOCHEMISTRY – I (Practical)

3 Hours/week

1. Analysis of crude drugs by chemical tests:
   i. Tragacanth
   ii. Acacia
   iii. Agar
   iv. Gelatin
   v. starch
   vi. Honey
   vii. Castor oil
2. Determination of stomatal number and index
3. Determination of vein islet number, vein islet termination and paliside ratio.
4. Determination of size of starch grains, calcium oxalate crystals by eye piece micrometer
5. Determination of Fiber length and width
6. Determination of number of starch grains by Lycopodium spore method
7. Determination of Ash value
8. Determination of Extractive values of crude drugs
9. Determination of moisture content of crude drugs
10. Determination of swelling index and foaming

Recommended Books (Latest Editions)

1. Practical Pharmacognosy: C.K. Kokate, Purohit, Gokhlae
2. Anatomy of Crude Drugs by M.A. Iyengar.

JAWAHRALAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B. PHARMACY II YEAR COURSE STRUTURE AND SYLLABUS

II Year B.Pharm. II Semester

L	T	P	C
1	0	2	2

(23BP405) SYNTHESIS OF API DRUGS (MINIMUM FIVE)
(Skill Oriented Course – II)

Scope: This subject is designed to impart fundamental knowledge on the structure, chemistry and therapeutic value of drugs. The syllabus also emphasizes on chemical synthesis of important drugs under different classes. This skill will enhance the ability of student to synthesis new chemical entities.

Course outcomes: Upon successful completion of this course the student should be able to:
1. Understand fundamental principles of synthetic organic chemistry for synthesizing APIs, including reaction mechanisms and stereochemistry
2. Analyse and predict the outcomes of key synthetic reactions commonly used in API synthesis, such as acetylation, alkylation, esterification, and amylation.
3. Understand the influence of molecular structure on chemical reactivity in API synthesis

SYNTHESIS OF API DRUGS (MINIMUM FIVE)

1. Synthesis of Non-Steroidal Anti-Inflammatory Drugs
2. Synthesis of Anti-convulsant drugs
3. Synthesis of Sedatives and Hypnotics
4. Synthesis of Anto-pyrine
5. Synthesis ofChlorobutanol
6. Synthesis of 7 hydroxy 4 methyl coumarin
7. Synthesis ofSulphonamides
8. Synthesis of Amines
9. Synthesis of Anti-bacterial
10. Synthesis of Anti-psychotic